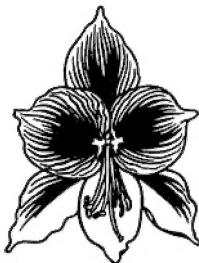


HERBERTIA

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2009



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David J. Lehmiller • Editor

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EDITOR'S COMMENTS

Members will note that BULBS has been combined with Herbertia into a single journal. This necessity has come about because of economic considerations; we have little choice in this matter considering that mailing expenses for our international members currently exceed publication expenses.

The name of our journal, Herbertia, was selected by the founders of our Society to honor the Father of Amaryllidaceae, William Herbert, Dean of Manchester, who was best known for his publication *Amaryllidaceae*. It is a great pleasure to announce that an important historical record is being published in this issue of Herbertia, the recently discovered and unpublished Botanical Notebook of John Carne Bidwill, one of William Herbert's colleagues from the period of the 1840s. Although originating from Great Britain, Bidwill eventually moved to Australia where he accomplished the bulk of his horticultural experiments. It was in Australia where this notebook was discovered by Colin Mills, who has provided us with a transcription of the Notebook including associated historical details; Mills also authors a separate account on one of Bidwill's significant contributions to horticulture, the bigeneric hybrids *xAmarygia* that are so popular in Australia.

The 2009 Herbert Medalist is Joseph Solomone of California, a pioneer in the development of yellow *Clivia* hybrids, and the 2009 Traub Awardee is Tony Palmer of New Zealand, Editor of BULBS.

Again the journal contributions reflect an international flair, with articles originating from Australia, Chile, India, Israel, Italy, Japan, South Africa, Switzerland, and the United States. The diversity of plants discussed encompasses multiple genera including four newly discovered taxa (*Alstroemeria*, *Crinum*, *Habranthus* and *Tulbaghia*), four reviews (Mexican *Habranthus*, *Rauhia*, *Tulbaghia* and *xBrunserine*), and three new taxon reclassifications (*Alstroemeria* and *Sisyrinchium*). Three articles relate field investigations (*Habranthus*, *Ledebouria* and *Tulbaghia*) and one details the flora of a mountainous locality (Mt Hermon). Two groundbreaking accounts are presented on interspecific hybridization (*Gloriosa* and *Lachenalia*). Additional articles discuss *Drimia*, *Hippeastrum*, and bulb movement in soil.

The obituary of former Herbert Medalist and long-time IBS member, Thaddeus Howard Jr., is published, and the latter "personal reflection" is followed by a synopsis of Mexican rainlilies discovered by Howard.

— David J. Lehmiller, Editor

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THE HERBERT MEDAL



The Herbert Medal is the highest honor that the International Bulb Society can bestow upon a person for meritorious achievement in advancing the knowledge of bulbous plants. The medal is named for William Herbert (1778-1847), son of Henry Herbert, Earl of Carnarvon. William Herbert had a predilection for amaryllids and achieved success in their hybridization. He published his research findings in several monumental works. His contributions as a pioneer geneticist and plant breeder, and his arrangement of the Amaryllidaceae, helped set the stage upon which other workers, both amateur and professional, have been able to advance.

The Herbert Medal may be awarded annually or on special occasions by the Board of Directors of the Society. Candidates for the Medal are recommended to the Board of Directors by the Awards and Recognition Committee. Medalists need not be members of the Society to be considered for the Herbert Medal. The award includes honorary life membership in the Society.

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1938 Mr. Jan de Graff, Oregon	1960 Prof. Ira S. Nelson, Louisiana
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1947 Mr. R. W. Wheeler, Florida	1973 Dr. Cesar Vargas, Peru
1948 Dr. R. A. Dyer, South Africa	1974 Sr. Pierfelice Ravenna, Chile
1949 Capt. C. O. Fairbairn, Australia	1975 Dr. John M. Cage, California
1950 Mrs. Mary G. Henry, Pennsylvania	1976 Mr. Floor Barnhoorn, South Africa
1951 Mr. Mulford B. Foster, Florida	1977 Mrs. Emma D. Menninger, California
1952 Dr. J. C. Th. Uphof, Florida	1978 Dr. W. S. Flory, Jr., North Carolina

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- | | |
|---|---|
| 1979 Mr. Harry Blossfeld, Brazil | 1998 Dr. Alan W. Meerow, Florida |
| 1980 Mr. Charles D. Cothran, California | 1999 Mr. Fred Meyer, California |
| 1981 Mr. W. L. Tjaden, England | 1999 Dr. Peter Goldblatt, Oregon |
| 1982 Walter & Hilda Latapie, Louisiana | 2000 Dr. A.A.De Hertogh, North Carolina |
| 1983 Mrs. A. C. Pickard, Texas | 2000 Dr. David J. Lehmler, Texas |
| 1984 Mrs. Marcia C. Wilson, Texas | 2001 Mr. Graham Duncan, South Africa |
| 1985 Dr. Hamilton P. Traub, California | 2002 Dr. Marcel Le Nard, France |
| 1988 Dr. Thomas W. Whitaker, California | 2003 Dr. Harold Koopowitz, California |
| 1988 Mr. Grant E. Mitsch, Oregon | 2004 Mr. Floris Barnhoorn, South Africa |
| 1988 Mr. L. S. Hannibal, California | 2005 Mr. Herbert Kelly Jr., California |
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| 1996 Dr. Maurice Broussard, France | |
| 1997 Sir Peter Smithers, Switzerland | |
| 1997 Dr. Dierdre Snijman, South Africa | |

**2009 HERBERT MEDALIST
JOSEPH SOLOMONE**

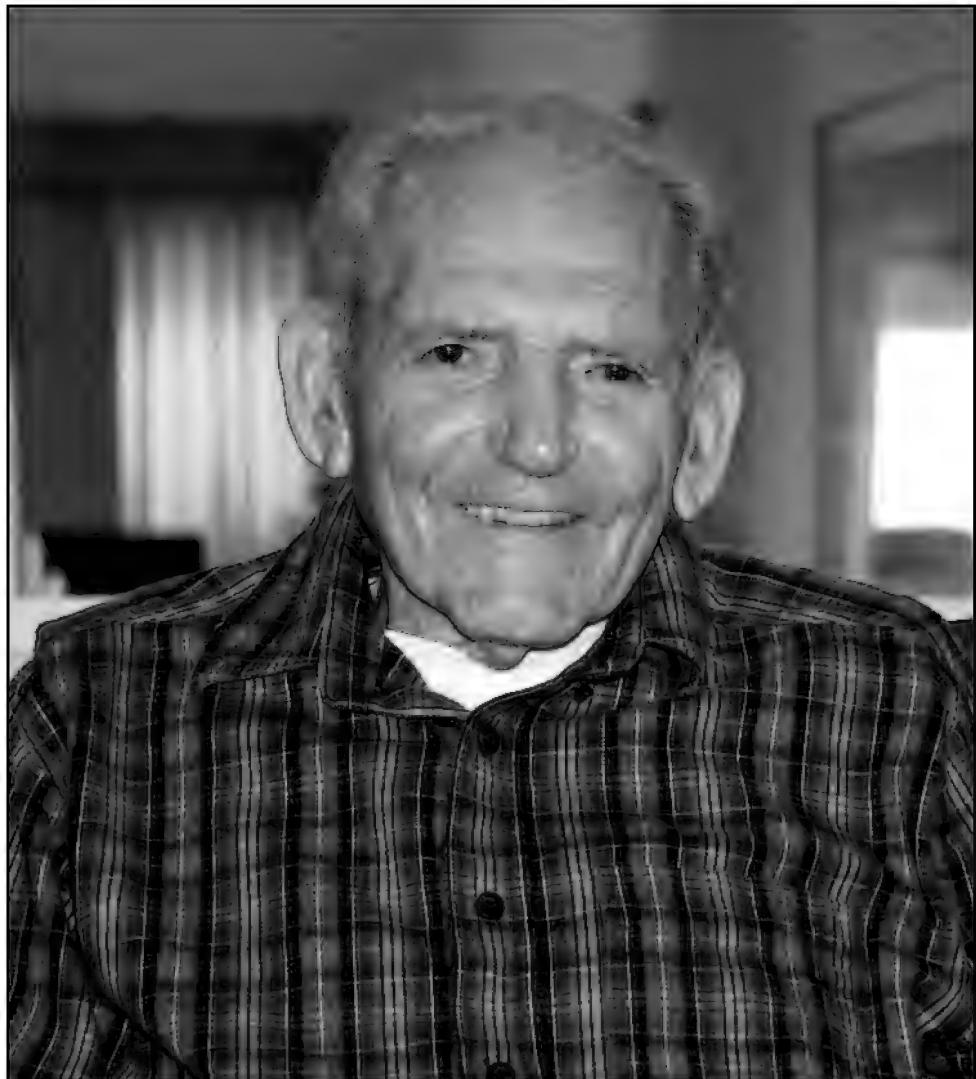




Fig. 2. Joseph Solomone's Herbert Medal in a bed of *Clivia* seed.



Fig. 4. Joseph Solomone as a young man in the US Navy.



Fig. 3. Solomone Family portrait, with Joseph Solomone seated. Left to right: Barbara Solomone (wife), Amy and Rachel Morales (granddaughters), Barbara Jo Morales (daughter), & Manuel Morales (son in law).

JOSEPH SOLOMONE

Biography by Tom Wells

President, North American Clivia Society

E-mail: ernestwells@mindspring.com

Joe was born on July 5, 1923, in the town of Downey, California which is located southeast of Los Angeles. Downey was founded in the second half of the Nineteenth Century and was home to farmers who grew castor beans, corn, grain and fruit till the end of first half of the Twentieth Century. Aviation also gained a strong foothold in Downey, starting with the Airplane Development Corporation in 1932 until the closing of the Rockwell Plant (Boeing) in 1999. During World War II and directly after, Downey was transformed from mainly farmlands to suburban homes and factories as returning Veterans opted to live in Southern California where the climate was mild and jobs were expanding with new post war development.

Today, one would never guess at the bucolic setting in which Joe was born and raised during his early years. That setting had a tremendous influence upon Joe and his future. Joe was like a sponge and absorbed things to which he was exposed. He used to work at his brother's dairy south of Long Beach near the Pacific Ocean, managing to spend time surfing before sunset whenever possible. From his surroundings, Joe developed a love and appreciation for growing plants and an early interest in aviation. Upon graduation from high school, he entered the Navy and was part of the Navy Air Corp during World War II. Joe loved the sea. His early years during the growing aviation boom coupled with the shift in California's agriculture during the 'Dust Bowl' of the 1930's, fostered his early development and cemented his love of horticulture.

World War II and the rapid growth of Southern California were instrumental in influencing Joe's working and family years. After the War, he entered the University of California at Davis; here he worked during his schooling as a Research Assistant in the Botany Department from 1947 till he graduated in 1950. His love for research never waned. Having been raised in a farm environment led Joe to settle in the Monterey Bay/Aromas area, where he married, raised his children, eventually opened his own business -- and called it "home". His wife Barbara, son Jeff and daughter Barbara Jo still reside in or near Aromas. The latter area still retains a

horticultural base economy that reminds a visitor of what Downey would have been like in the 1920's and 30's.

With his B.A. Degree in Agronomy, Joe's working years began, starting in 1951 as a Landscape Contractor in Carmel. Then from 1953 to till 1986, he managed several nurseries, developed stock for the landscape industry, and sought out California native plants to use in landscaping. Joe opened Monterey Bay Nursery in 1986; he sold the latter in 1988 to Manuel Morales and Luen Miller, taking only his *Clivia* collection with him into retirement.

In 1966, Joe noticed a seedling in a group of *Clivia* being raised for sale; this plant had a yellow bloom deep in its leaves. This intrigued Joe, and thus started his affair growing what is now famously known as "Solomone Yellow Hybrids". After Joe retired in 1988, he continued privately working with Clivia; he said his goal was to stabilize his hybrids so that they could be used for landscape applications. He never felt that he really achieved his goal, but his hybrids were amongst some of the worlds finest and could be found in collections worldwide. When asked in 2005 about that first yellow *Clivia*, Joe looked out upon the 3 acres of *Clivia* plants at his green house and stated that unfortunately, when moving into Plant Horizons, his final greenhouse, it had been lost; but he believed it would someday be rediscovered amongst all the thousands of his plants.

While known around the World for his *Clivia* hybrids, Joe worked with hybridizing many other plants, including native North American plants from *Ceanothus*, lupins, varieties of *Eucalyptus*, *Sequoia*, ferns and others for landscape applications. After retiring in 1989, Joe became a research horticulturalist at Saratoga Horticultural Research Foundation, becoming the Director in 1994. While there he sought out plants from various locations around the world to research for their landscape application in California and other North American locations.

Joe devoted his entire life to horticulture, making his mark over many years and in many areas. He was very proud that IBS chose to award him the 2009 Herbert Medal.

ACCOMPLISHMENTS

Solomone *Clivia* Yellow Hybrids
Solomone *Clivia* Yellow Charms
Solomone *Clivia* Variegates
Grevillea 'Aromas'

Solomone *Clivia* Little Charms
Solomone *Clivia* Watercolors
Ceanothus 'Snow Flurry'

1995. Elmer J. Merz Award, California Association of Nurserymen.
1995. Curtis B. Alley Merit Award, International Plant Propagators' Society.
1997. James H. Wilson Nursery Service Award, Peninsula Chapter of California Association of Nurserymen.
2006. Award of Merit, *Clivia* Society of South Africa.

All photographs by the author.

Editor's Note: Joe Solomone passed away on May 30, 2008, just a few short months after receiving his Herbert Medal.



Fig. 5. Present for the Joseph Solomone Herbert Medal Award on February 2, 2008, left to right: Pamela Kelly, Herbert Kelly Jr., Barbara Solomone, Joseph Solomone, James Comstock, Mary Glover (caregiver), & Manuel Morales.

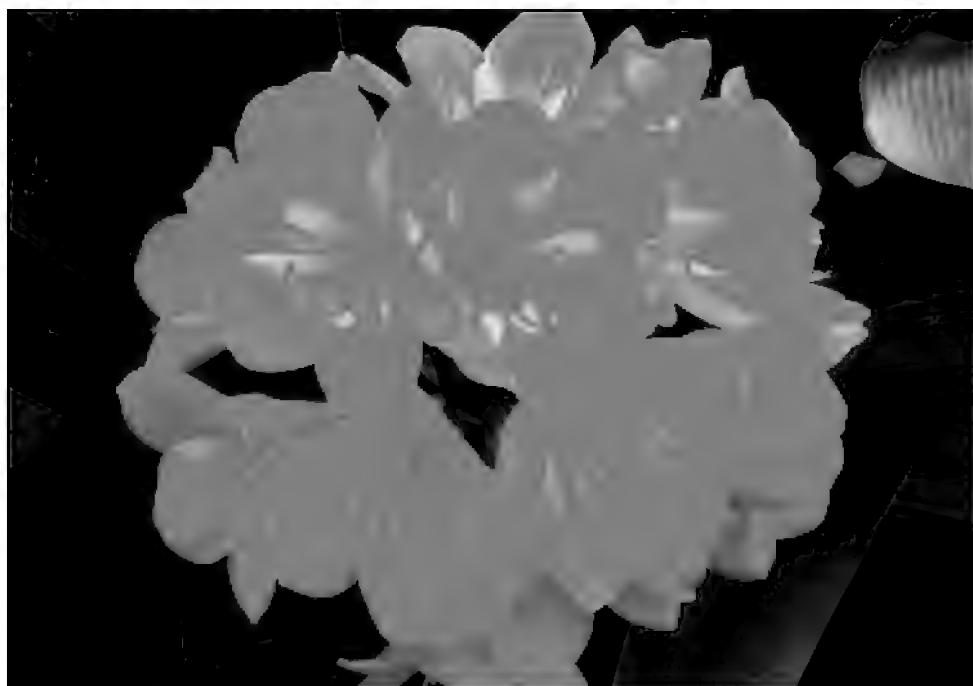


Fig. 6. Solomone *Clivia* hybrid.



Fig. 7. Solomone Clivia hybrid.



Fig. 8. Variegated Solomone *Clivia* hybrid.



Fig. 9. Solomone *Clivia* 'Amy's Happy Face'.

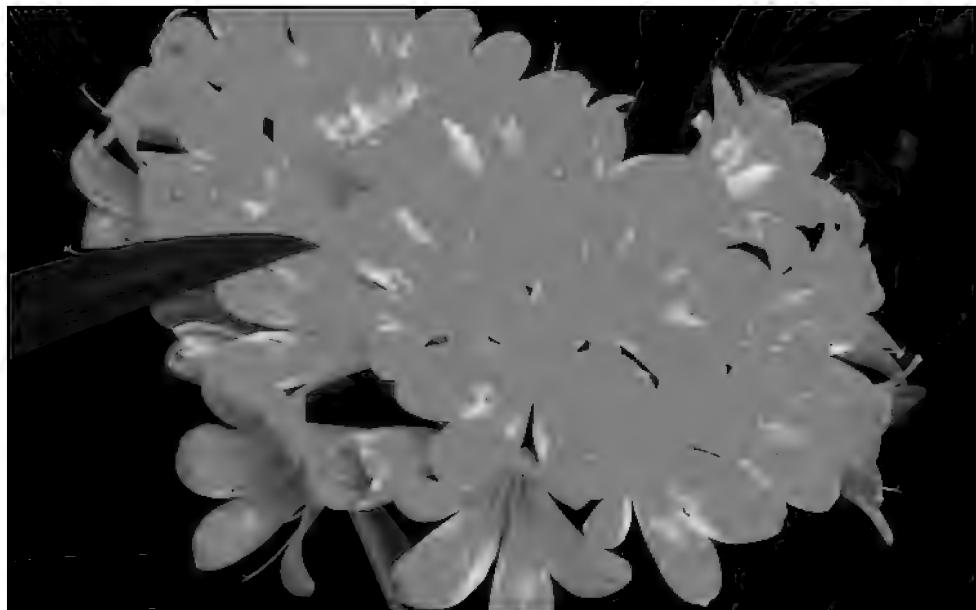


Fig. 10. Solomone *Clivia* 'Maricela's Choice'.

JOSEPH SOLOMONE TESTIMONIALS

JOE SOLOMONE, CLIVIA BREEDER

By Jim Shields

Former President, North American Clivia Society

E-mail: jshields@indy.net

I have known Joe for barely 6 years, but I have developed a tremendous respect for the *Clivia* strains he has developed. Joe developed his yellow strain by looking for self-fertile plants to use as parents. His plants were all held until after their first flowering, so they could be classified unambiguously by flower color. Solomone clivias are the hardiest, most vigorous *Clivia* plants I have grown. Where other growers have plants selected for the flowers, Solomone has clearly selected for vigor as well. His plants are almost all large, full sized clivias.

Joe Solomone was probably the first *Clivia* grower in North America to produce and release to the market good quality yellow flowered *Clivia minata* plants in large numbers. Outside California, his yellows were sold under his name by Wayside Gardens, and at prices much more reasonable for the average plant lover than the only other yellow then on the market in the U.S.

In recent years, his new “Watercolor Washed” line strongly resembles the “Parti-color” line from Conway. The flowers have multiple tones of pastel orange or pink with some areas almost white. Solomone also began selecting for smaller plants and smaller flowers, which he called his “Charm” line. He has offered ‘Charm Yellow’, ‘Charm Pastel’, and ‘Charm Pink’.

Joe also developed some very interesting clonal cultivars just at the end of his active participation in the *Clivia* nursery. A fine peach reminding one of David Conway’s ‘Tessa’ was named ‘Apricot’. He has a green-throated red called ‘Saint Patrick’ that caught many an eye when its picture appeared in a national gardening magazine a few years ago. Joe exchanged plants with David Conway, so there are probably some Conway genes in the Solomone line, and perhaps the reverse as well.

The Solomone *Clivia* greenhouse was “manned” by his long time employee, Maricela. She handled much of the work alone, but occasionally pressed her sister and bother-in-law into helping out.

CONGRATULATIONS, JOE SOLOMONE

By Kathy Andersen

Secretary, International Bulb Society

Secretary, North American Clivia Society

E-mail: ksa2006@verizon.net

Congratulations to you on receiving the Herbert Medal of the International Bulb Society for your lifetime efforts in developing the finest *Clivia* hybrids. You have done a true service to all who appreciate beauty in widely distributing these plants, especially the yellow ones.

I treasure the plants I acquired when you opened your greenhouses to members of the North American *Clivia* Society on several occasions. Each year when these plants come into bloom, I think of you and all the magnificence you have created.

JOE SOLOMONE'S GREENHOUSE

By James Comstock

Clivia Breeder and Photographer

E-mail: jchiho@earthlink.net

I walked into Joe Solomone's greenhouse and my jaw dropped. I think Harold Koopowitz had to come over and poke me to make sure I was okay. Ten of thousands of clivias, better yet, YELLOW clivias!! I never could have imagined.

That was my first experience with Joe Solomone in the late 1990's. And I know it's an experience that has been repeated with many a *Clivia* lover who has made the pilgrimage to Joe's. And then, after the initial shock has subsided, you start to walk up and down the aisles finding all the unique treasures that you want to grab and run out to your car with.

It certainly can be said that Joe Solomone has helped to popularize clivias. And I think this effect is something larger than even Joe could ever have imagined as his name is now known worldwide as one of the giants of the *Clivia* world.

From an initial intent to produce a true-breeding line of yellow landscape *Clivia*, Joe's decade's long breeding program has unlocked the genetic potential of *Clivia miniata*, demonstrating the variety of form

and color possible. It is the vision of this potential that Joe has generously shared with plant lovers to excite and inspire them to grow and enjoy clivias.

One thing that Joe gave me was a vision of an ideal. This has been both an inspiration and a frustration. Devoted to a good sixth of his 5 acre greenhouse, was an area devoted to growing hundreds of his mother plants in large tubs with years of growth. And, of course, since I was usually there in the flowering season, each tub was overflowing with flowers. For me, this became the ultimate way to grow *Clivia*. Only when one allows a seedling to multiply and mature like this can one judge the true potential and growth habit of a plant. In climates where clivias must be grown indoors, one understandably has to limit the size of plants. For those of us who can grow clivias outside in huge structures, a large specimen can show a beauty that a single division can't even suggest. Nowhere have I seen growers with the number of mature specimens as Joe. This at a time when people with a beautiful flower will often carve off the first offset to sell.

Within Joe's plants were specimens that were obviously of finer overall form than others. And because of the quantity to select from, I could always find one plant that not only had a gorgeous flower, but a great umbel held attractively over a beautifully balanced mass of leaves from many offsets. In my own breeding, these qualities have become a significant part of the criteria on which I select my plants. But herein lays the frustration. Joe has spoiled me. I don't have (and won't for the foreseeable future) a five acre greenhouse or shade house or anything close. I dream. And it takes years to grow a seedling to form a large specimen. This so I can say with confidence and experience to those with whom I will eventually share my hybridizing efforts ... "this is a beautiful plant ... no ... this is an exquisite plant!"

As I lived in Southern California, a good five to six hour drive from Joe Solomone's nursery, I was often generously invited to stay with Joe and his wonderful, charming wife Barbara. In one of many conversations, Joe told me that he used to live in Southern California. In fact, in the 1940's, he told me, he used to go surfing off Corona Del Mar ... in the nude. I found it quite amusing to realize that in that area, it was so sparsely populated that a surfer could find a remote enough location to surf au naturale, in the 40's. Today, the coast there is so heavily developed that Joe would be in jail before his skeg hit the water. (A "skeg" is a surf term for the fin on the

surfboard.) Now, Joe was a tall man, with broad shoulders. He must have been an impressive site to see riding the waves. Little did those few who did see him know that they were looking at a future king, albeit a King of Clivias.

MY FRIEND, JOE SOLOMONE

By **Herbert Kelly, Jr.**

President, International Bulb Society

E-mail: herbk76@aol.com

The name Joseph Solomone will live on as an icon in the Clivia World, with his name written in Clivia History as a pioneer of yellow *Clivia* breeding. I will always cherish the many times I visited his operation, viewing an ocean of stunning clivias in bloom. Many exquisite specimens traveled home with me following these visits. The memories of Joe Solomone, Manuel Morales, Maricela De La Torre and her sister Irma Marquez, hybridizing plants, harvesting seeds, and maintaining and carrying on the clivia operation will always remain with me. The vision of almost one million spectacular clivias, many in bloom exhibiting colors and forms I had never seen, covering about three acres, has been a breath-taking experience. Joe is gone, but his friendship and the wonderful memories over the years will live on. The plant world has been enriched by his presence. He will never be forgotten.

All photographs by Herbert Kelly, Jr.



Fig. 1. Joseph Solomone immediately after receiving the Herbert Medal on February 1, 2008. Left to right: two nursing home attendants, Joseph Solomone, Barbara Solomone, and James Comstock.



Fig. 2. Manuel Morales (left) and Maricela De La Torre (right) with Solomone Clivia 'Amy's Happy Face' in Solomone Greenhouse, March 28, 2008.



Fig. 3. Maricela De La Torre (left) and Irma Marquez (right) in Solomone Greenhouse, March 28, 2008.



Fig. 4. Solomone Cliva hybrid.



Fig. 5. Solomone *Clivia* hybrid.



Fig. 6. Solomone *Clivia* hybrid.

THE HAMILTON P. TRAUB AWARD FOR DISTINGUISHED SERVICE

This award was established in 2000 by the IBS Board of Directors to recognize meritorious service to the Society. It is named after Dr. Hamilton P. Traub, founder of the American Plant Life Society, antecedent of IBS, and editor of its journals for a half century.

PAST RECIPIENTS

2000	Mr. Charles E. Hardman	2005	Dr. Charles Gorenstein
2001	Mr. Marvin C. Ellenbecker	2006	Mrs. Pamela J. Kelly
2002	Mr. Michael G. Vassar	2007	Mr. Karl E. King
2003	Dr. Alan W. Meerow	2008	Mr. William T. Drysdale
2004	Dr. David J. Lehmiller		

2009 TRAUB AWARD TONY PALMER



TONY PALMER AUTOBIOGRAPHY

I was born in 1942 at Carshalton near London, England. My earliest memories involve plants in one way or another. I used to accompany my Dad to the local park where the allotments or community gardens were. It was after the war had finished and there were still severe shortages, so we grew our own vegetables and some flowers. I loved helping to harvest the potatoes, keeping my eyes open for the dreaded Colorado beetle whose picture was on the posters at the entrance to the gardens. Maybe that gave me my later interest in insects and one of my main childhood hobbies, collecting butterflies and moths. Very non pc now but quite common then. Ironic that some of the most interesting places to explore were the overgrown London bomb sites where many rare species of insects had made their homes because of the often unusual plants growing there. An early Ecology lesson!

My parents must have been very tolerant to have allowed me to spend hours in the back garden with a white sheet spread out on the lawn and a mercury vapour lamp on it to attract the moths, which it did in great numbers -- along with lots of beetles and other assorted bugs, until there were creepy-crawlies all over the house. Or when we went on holiday to let me take a box full of enormous privet hawk moth caterpillars which escaped in the hotel bedroom, much to the chambermaid's horror! And of course I was constantly asking them to stop the car every time I saw a privet hedge to collect more food to satisfy their voracious appetites.

We had an air raid shelter in our back garden covered over with a large mound of soil, and I converted this into my first rock garden, carefully tending a range of alpine plants including bulbs. I also had my own small vegetable garden and grew some very respectable lettuce, carrots, etc., which I proudly harvested and presented to Mum.

So was there really any career choice when I left school other than Horticulture – probably not. I didn't particularly like or do particularly well at school, but I really came into my own when I went to Horticultural College to do my Diploma. That was a 1 year course, after which I did 2 years at Cambridge University Botanic Garden which really enthused me. The Director, J.S.L. Gilmour was a real inspiration to us students, and it was an amazing place to learn about a huge range of plants. This was also

where I met my future wife, Jenny. Together, we spent countless hours combing the countryside to study wildflowers and became heavily involved with Dr. Franklyn Perring and the Botanical Society of the British Isles Atlas Project. This gave me a great insight into, and enthusiasm for, plant conservation. We also had a partially successful letter writing campaign to the newspapers to try to stop the local councils mowing the road verges and destroying many rare wildflowers in the process.

After a short spell in The Cambridge University Estate Management Department, Jenny and I decided to emigrate to New Zealand. This was supposed to be for a two year trial period. When our families and friends came to see us off at Southampton, my brother whispered to me that he didn't think we would come back. How right he was! I worked for the first two years with the Auckland City Council and then applied for a job with the University of Auckland. I was considered too young for the position in charge of the Grounds Department, but they were sufficiently impressed with my qualifications and experience that they created a new position for me as Assistant Horticultural Supervisor. I was with the University for just over 40 years up to my retirement in February 2009, having been Grounds Superintendent for many years.

At Cambridge a lot of New Zealand native plants were grown, and it was exciting to see them in their natural habitat and to grow them without the aid of glasshouses! We quickly joined the Auckland Botanical Society as we thought that was the best way to learn the flora, and what a contrast that flora was to what we were familiar with. We went on many fascinating and sometimes challenging trips, such as when we climbed Mount Moehau at the northern tip of the Coromandel Peninsula. This is the closest place to Auckland to see alpine plants.

Talking of alpine plants, it wasn't long before we started growing alpine and groundcover plants, both native and exotic, inspired by a local nursery, Joy Plants, owned by Terry Hatch - a Life Member of the IBS - and his wife Pam. Soon we had too many for our own use and to give away, so we started selling them and that started a lifetime of having a small part time nursery of our own. A few years after we started, we imported a whole lot of bulb seed from what was then a well known South African supplier, and the success we had growing many interesting species led us to concentrate on selling bulbs. We augmented our collection with more seed from South Africa, this time from Silverhill Seeds, and all the usual other means of

developing a plant collection – Society seed lists, swapping with other enthusiasts, buying from other growers and garden centres, etc. And here we are 29 years later still going strong and with plans for expansion now that I have retired!

I have very much enjoyed my five years as Editor of BULBS for the IBS and was thrilled to hear via a surprise phone call from Herb Kelly that I had been awarded the Hamilton P. Traub Award – something I will always treasure. However, like Oscar winners, I must thank all those who have helped me over the years, especially Alan Meerow for his invaluable guidance, and Carol Longley, also here in Auckland, who did the layout which is of such a high standard. Mustn't forget the authors either, without whom there would be nothing for me to do!

BREEDING GLORIOSA

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(Translation provided by Helen Marriott of Australia.)

I first encountered *Gloriosa* about 50 years ago (1959) when I was 20 years old. The *Gloriosa* vines were rambling over Mr. Atsushi's fields in Yokohama City. Later I learned that these were *G. superba*.

When I was 17 years old one of my friends, who worked in the American Occupation Army (which was stationed in Japan) and who was really interested in the breeding of *Gladiolus*, showed me an American flower catalogue. At that time Japan was suffering a food shortage because of its defeat in the war, but I was really interested in flowers. My parents were farmers so I was able to smoothly change the family's occupation to a flower nursery. We mostly grew bulbs and they did well, but it was much later that *Gloriosa* became a main focus for me. At the time, *G. superba* (orange and yellow with narrow wavy petals) and *G. rothchildiana* (red and yellow with broad and wavy petals) were being sold as single flowers in the cut flower trade, and these species didn't do so well.

From that time I began to randomly collect many bulbs, focusing on the various species. Following the success of the Tokyo Olympics in 1964, Japanese people commenced travelling overseas, and several times I went to Holland which was an advanced horticultural country. I had been receiving for a long time a catalogue from the Van Tubergen Company, which was a pioneer bulb company, and so I was especially interested in this company and went there with a translator. There I was able to obtain some *Gloriosa* species. There were four species which I obtained:

G. lutea (pale yellow colour with narrow and wavy petals);

G. carsonii (yellow with brown and purple colour and flattish petals);

G. plantii (small orange flower with a flat petals); and

G. verschuurii (orange and yellow with wavy petals, a dwarf plant).

Later I also obtained from a Japanese bulb collector friend *G. greenii* (bright yellow, medium flower, flat petals) and from another friend, *G. rothchildiana* (deep red, small flower, wavy petals, a dwarf plant). From India I obtained a dwarf form of *G. rothchildiana* with a large flower. I also obtained from South Africa *G. superba* (pale orange with wavy petals). I managed to assemble all of these plants about 30 years ago.

I started by collecting the seed from these plants and then moved into mass propagation. While selling the plants, I also started to cross the different species with each other. Around this time, the cut flower material of *Gloriosa* changed from being sold only as a single flower to a flower with its stem and leaves, and perhaps because of its novelty, sales increased rapidly. Bulbs also sold well, and these good commercial conditions continued for a number of years.

In the meantime I was unable to discover any special coloured flowers among my *Gloriosa* hybrids. Then all of a sudden, about 10 years ago, I discovered a pure white flower among my *Gloriosa* hybrids, which I named *G. 'White Wing'*. This 'White Wing' produced 5 extra bulb offshoots over the next 2 to 3 years, and then a Japanese seed company which was a client, expressed a wish to purchase all of these bulbs for 20-30 million yen (about US\$220,000-330,000) at the time. I was extremely happy and went to the green house to check them, but they weren't there. I asked a part time staff member what had happened, and she said that the bulbs had been shipped to another mail order seed company along with a pink cultivar. I was terribly surprised and immediately contacted that company, but it was already too late because they had shipped the goods to various buyers. They promised to let me know if a white flower emerged, but in the end nothing came of it. It was pointless to attack the staff, and I had to accept that what happened was my own fault. But I couldn't stop being angry for a whole week.

Nevertheless, I knew that I could develop a pure white *Gloriosa* flower from my breeding, so I tried again to undertake many crosses with my *Gloriosa*, wishing to have my dream come true again. About 5 years ago (2004), many *Gloriosa* hybrids bloomed with a whole variety of colours. I was excited and took many photographs so I could make a new file of about 100 different cultivars. However, a white one didn't appear. So I had to decide whether or not to perform more *Gloriosa* crosses.

In 2008 I attended the IPM Horticultural Show in Germany, and my



Fig. 1. *Gloriosa* 'White Wing'.

file of *Gloriosa* photographs was displayed in the Japanese pavilion. These were very popular, but then the file went missing; however, it was later returned to me after I returned to Japan.

One weakness of *Gloriosa* is that after these are cultivated for a few years, they can be attacked by a virus. Tissue culture can remove the virus; however, at this point in time, tissue culture is not an efficient process. Even Holland hasn't progressed much with this research. Recently, a large Japanese research institute has been developing a treatment for the virus. I am now cooperating with this institute and am conducting a test on *Nerine* at the moment.

Anyway, I am looking forward to again coming across a pure white *Gloriosa* hybrid like 'White Wing'.

All photographs by the author.

Editor's Note: A special thanks is extended to Shigetaka Sasaki for coordinating the acquisition of both articles by Satoshi Komoriya that appear in this volume of *Herbertia*.



Fig. 2. *Gloriosa* hybrid (-1048).



Fig. 3. *Gloriosa* hybrid (-1443).



Fig. 4. *Gloriosa* 'Mikan' (-1023).



Fig. 5. Multipetalled *Gloriosa* hybrid (-1032).



Fig. 6. *Gloriosa* hybrid (-1539).



Fig. 7. *Gloriosa* hybrid (-0605).



Fig. 8. *Gloriosa* hybrid (-0611).



Fig. 9. *Gloriosa* hybrid (-1555).



Fig. 10. *Gloriosa* hybrid (-1716).



Fig. 11. *Gloriosa* hybrid (-1723).



Fig. 12. *Gloriosa* hybrid (-1722).



Fig. 13. *Gloriosa* mini orange bicolor hybrid (-0935).



Fig. 14. *Gloriosa* hybrid (-1050).



Fig. 15. *Gloriosa* hybrid (-1724).



Fig. 16. *Gloriosa* hybrid (-0954).



Fig. 17. *Gloriosa* ivory lemon hybrid (-0910).



Fig. 18. *Gloriosa* mini gold hybrid (-0933).



Fig. 19. *Gloriosa* yellow red straight petals hybrid (-0947).



Fig. 20. *Gloriosa* hybrid (-0838).



Fig. 21. *Gloriosa* mini bicolor hybrid (-0909).



Fig. 22. *Gloriosa* hybrid (-1447).



Fig. 23. Gloriosa lime hybrid (-0958).



Fig. 24. Gloriosa hybrid (-1734).



Fig. 25. Gloriosa mini flower hybrid (-0945).



Fig. 26. Gloriosa hybrid (-1649).



Fig. 27. *Gloriosa* hybrid (-1743).



Fig. 28. *Gloriosa* hybrid (-0952).



Fig. 29. *Gloriosa* hybrid (-0855).



Fig. 30. *Gloriosa* hybrid (-0834).

JOHN BIDWILL'S BOTANICAL NOTEBOOK

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JOHN CARNE BIDWELL

John Bidwill was born on February 5th, 1815 at Exeter in England where his father, Joseph Green Bidwill was a merchant. I know nothing of his education but he appears to have had an early interest in botany and in bulbs, probably through an association with the great English nursery of Robert Pince, close to Bidwill's home at St. Thomas. He left England for Canada in 1832 when only 17, spending nearly three years there, returning in 1834. Four years later he again left England, this time with his sister Elizabeth, bound for Sydney to further his father's business interests, arriving on September 1st, 1838. By this time he was already hybridizing gladioli with some success, taking some of his hybrids with him to Australia (Herbert, 1844). His business interests also took him to New Zealand several times where he is acknowledged as an important early explorer and botanist. In 1845 and 1846 he spent almost a year in Tahiti with a view to settling there.

He quickly established a reputation as a botanist in the colony of New South Wales and, through regular correspondence with such English botanical luminaries as William Herbert, John Lindley and William Hooker, also became known in England. From 1842 to 1854 he appeared regularly in the correspondence columns of *The Gardeners' Chronicle* of London. I have found 12 letters that I can ascribe to Bidwill during this period and an additional 7 letters or articles in which he is mentioned. His death in 1853 was followed by 2 lengthy obituaries in *The Gardeners' Chronicle*, in 1853 and 1856.

Apart from these letters the book 'Rambles in New Zealand', published in London in 1841, is Bidwill's only published work (Bidwill, 1841). A large number of his many letters to Australian friends and colleagues are still extant, most of them held in the Mitchell Library, Sydney, and these contain invaluable information on his botanical discoveries and his hybridizing work, as does his extensive correspondence with English

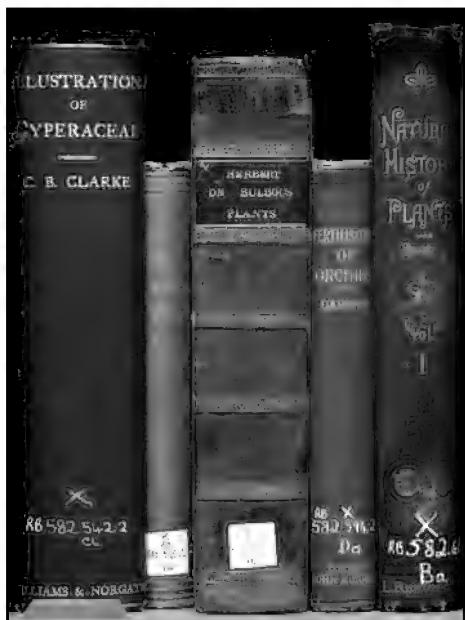


Fig. 1. Herbert on Bulbous Plants - on the shelf at the Library of the Australian Herbarium, Special Collection. Photograph courtesy of the National Herbarium Library.

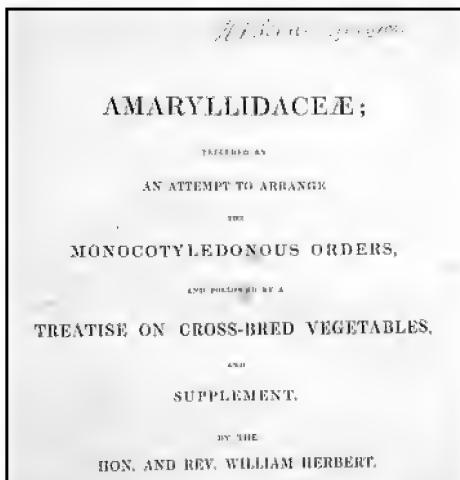


Fig. 2. The flyleaf of William Herbert's Amaryllidaceæ signed J. C. Bidwill, Sydney, 1840. Photograph courtesy of the National Herbarium Library.

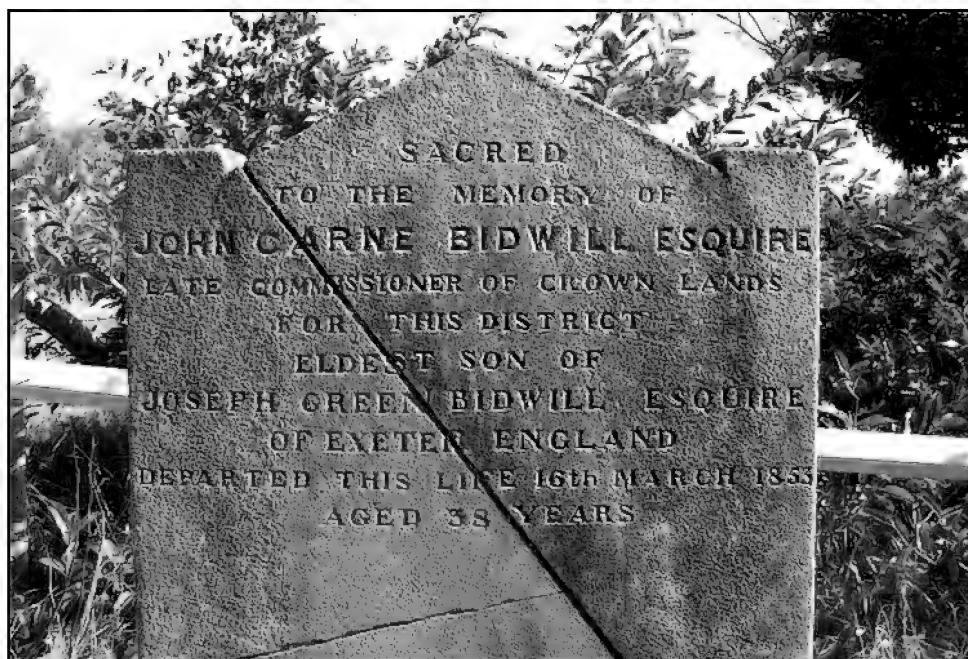


Fig. 3. Bidwill's headstone at his grave site, Tinana, Maryborough, Queensland. The grave site was restored and the headstone repaired and re-erected in the 1980s. Photograph by Colin Mills.

botanists. However, the discovery of his botanical notebook in 2004 is particularly important because of the detail of his work that it provides, particularly concerning Amaryllidaceae, but also because of the insights it provides into the way that Bidwill thought and worked.

BIDWELL'S NOTEBOOK

The notebook was found during a search for William Macarthur's botanical library, the bulk of which was dispersed in 1969/1970. This search was in furtherance of my research into the plants grown at Macarthur's home, Camden Park, New South Wales, in the colonial era. From books surviving at Camden Park it was clear that Macarthur was in the habit of writing pencil notes in his books and journals and so examination of the books he owned was a research imperative.

Most of Macarthur's library was purchased by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in 1969 and is now housed in the Special Collection of the Library of the National Herbarium, CSIRO Plant Industries, Black Mountain Laboratories, Canberra. I found Bidwill's notebook bound with a first edition of William Herbert's 'Amaryllidaceae', the title 'Herbert on Bulbous Plants' embossed on the spine (Fig. 1). Inside is a 1830s bookplate of James and William Macarthur, but the flyleaf of 'Amaryllidaceae' is signed J. C. Bidwill, Sydney, 1840 (Fig. 2).

It is my belief that both the book and the notebook, with other effects, passed to William Macarthur on the death of Bidwill in 1853 although I have no specific documentary evidence of this. Macarthur probably bound both documents into a single volume as they are found today. The notebook takes up half of the bound volume and is written almost entirely by one hand, identifiable as that of John Bidwill. Comparison with his signed letters shows an overall similarity of hand, the identical rendering of certain words, such as 'Sydney', and a number of very distinctive idiosyncrasies such as words ending in double 'l', where the second 'l' is invariably much shorter than the first. Bidwill's notes are in ink but there are a small number of apparent additions, sometimes in a different hand and sometimes in pencil.

The period covered in the notebook is from about 1841 to 1853 but the bulk of the notes are for the period 1841 to 1846 and almost exclusively deal with Amaryllidaceae, being a mix of commentary and descriptions

of species, varieties and hybridising experiments. There are several cross-references to Herbert's 'Amaryllidaceae'.

1852 and 1853 entries describe experiments with the seeds of bananas and a comparison of 13 varieties of Pineapple. The work described in this section was carried out at Bidwill's garden at Tinana, Wide Bay, on the banks of the Mary River, now a suburb of the town of Maryborough, Queensland, where Bidwill died in 1853 (Fig. 3). Bidwill was appointed Crown Commissioner to Wide Bay in November 1848 after he was replaced as Director of the Sydney Botanic Garden by Charles Moore following an unfortunate lack of communication between the Governor of New South Wales, who appointed Bidwill to the post in September 1847, and his immediate superior, Earl Grey, the Colonial Secretary in London, who appointed Moore to the post in February 1848.

The notebook consists of 93 pages plus 8 pages of Index. All but the first page of the notebook are double, a total of 185 note pages, most still blank. Except for the first page, all are numbered on the left page only. Completely blank pages are indicated in the transcription.

NOTES ON THE TRANSCRIPTION

I have retained the pagination of the notebook. Amendments and crossed out words are included with an explanatory note in square brackets where needed to make sense of the text. In most cases amendments appear in the transcription exactly as in the notebook. An example from page 3; '... winter ~~of its existence~~ was that...'

I have used square brackets to indicate a word or words that I have been unable to decipher. This example from page 1: '...within ½ inch – sometimes largely [1 word undeciphered] near the base...' In this case I have been unable to decipher one word between 'largely' and 'near'.

I have also used squared brackets to indicate a word of which I am uncertain. This example on page 2; '...or nearly so – [word indistinct, probably] hood concave...'

With some exceptions notebook entries are working notes and are only partially punctuated. Individual words and statements are often divided by a dash, or, more commonly by a space-period-space combination. This example on page 1; '...be prostrate . not glaucous . margins...' The punctuation of the notebook is followed in the transcription.

Sometimes a gap is left between words on a page or paragraphs on a

page, suggesting an intent to add further notes at a later date. This may be important in making sense of the notes so I have shown where such gaps exist and the size of the gap in centimetres, again using square brackets to indicate an editorial intrusion. Other editorial intrusions are also bounded by square brackets and have been kept to a minimum.

PEOPLE AND PLACES MENTIONED IN THE TEXT

Camden. Now Camden Park, NSW, home of the Macarthur family.

William Macarthur was a renowned plant collector and hybridiser and close friend of Bidwill, who carried out much of his work at Camden. Bidwill was a frequent visitor to Camden, his visits recorded by Emily Macarthur in her diary; 2 in 1840, 3 in 1841, 2 in 1842, 1 in 1843, that year spent largely in England, 5 in 1844, 0 in 1845, much of that year and 1846 spent in Tahiti, at least 2 in 1846 but not recorded by Emily, 12 in 1847 and 2 in 1848, the year he left for Wide Bay. This list is unlikely to be exhaustive. The visits lasted from less than one day to several weeks.

E. Bay. Elizabeth Bay House, home of Sir Alexander Macleay, natural scientist and NSW Colonial Secretary from 1826 to 1837. He was well known in scientific circles in Britain as he was Secretary of the Linnaean Society of London before coming to New South Wales.

Edward Bowman, E. B. Edward Macarthur Bowman, son of Dr. James Bowman and William Macarthur's eldest sister Mary. Edward, only in his late teens at the beginning of this period, was a close friend of Bidwill's and, often with William Macarthur and Philip Parker King, accompanied Bidwill on a number of botanising excursions. The Bowman's Sydney home was Lyndhurst, which is specifically mentioned in the text. They also had a property at Ravensworth in the Hunter Valley, frequently visited by Bidwill. Edward Bowman collaborated with Bidwill on a number of projects, but particularly hybridizing gladioli.

Gov. Gard., G. G. Government Garden, now the Royal Botanic Gardens, Sydney.

Kidd. James Kidd commenced work as an Overseer at the Sydney Botanic Garden in 1833 and was Superintendent of the gardens from August 1844 until August 1847. On September 1st of that Year John Bidwill commenced duties as the first Director of the Botanic Gardens and James Kidd reverted to the post of Overseer.

Lady Gipps –the wife of Sir George Gipps, Governor of NSW from 1838

until 1846.

Lyndhurst. Sydney home of the Bowman family.

Mitchell. Sir Thomas Mitchell, Surveyor General of New South Wales from 1827 to 1855, explorer and plant collector.

Mr. M'A, Mr. McA. Although there was a sizeable clan of Macarthur's in NSW at this time, this is certainly William Macarthur of Camden.

Mr. M^cL. Alexander Macleay of Elizabeth Bay House.

O'Connell Street. Conn. O'Connell Street was at the time a major street in central Sydney.

Sir John Herschel. Mathematician and astronomer, lived and worked in South Africa from 1833-38, occasional correspondent of William Macarthur.

V D Land. Van Dieman's Land, now the State of Tasmania.

ACKNOWLEDGEMENTS

Particular thanks are due to the Library of the National Herbarium, CSIRO Plant Industries, Black Mountain Laboratories, Canberra, ACT for providing me with free access to their Special Collection in the furtherance of my research, and for permission to publish this notebook. I particularly wish to thank Kirsten Cowley for her skill and patience, making the many hours spent there both pleasant and productive. David Jones, then of the National Herbarium provided great assistance in transcribing the notebook.

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THE NOTEBOOK

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Page 1

Crinum Koeganense – leaves about 9 multifarious, sheathing 1½ to 2 feet long, 1½ inches wide edges approximating upwards to within ½ inch – sometimes largely [1 word undeciphered] near the base, greatly curved backwards, otherwise would be prostrate . not glaucous . margins quite entire . tube pear shape about 3 inches diameter, white, silky outside, not deciduous at Sydney –

This bulb was given by Sir John Herschel to Lady Gipps at the Cape with the name Amaryllis Koeganense; but is evidently a Crinum. Although it has been nearly five years in Sydney and has never been disturbed it has not flowered and has made but one offset, which I have – May be C. Algoense – Page 272 [of Herbert's Amaryllidaceae] Oct 6th 1842

[These 2 paragraphs are marked with a line down the left side and with the words – This plant is *Crinum revolutum*]

[5 cm space]

Crinum Koeganense – Another plant in the same collection – Leaves glaucous but bright. 3 inches wide at the base largely undulated – young leaves not undulated $\frac{1}{2}$ inch wide blunt – channeled – ciliated . a much larger plant than the other – not in the least like it. I had overlooked it through mistaking it for a *Veltheimia* amongst plants of which it was growing and which it resembled in the colour of its leaves. It is evidently different from either *revolutum* or *variabile* and from the leaves not being “tortuous” is not likely to be *campanulatum*.

Page 2

Crinum [4 cm space] ? From Port Macquarie ? New England ? [the question marks are Bidwill's] perhaps grows along with *C. flaccidum* – In Gov. Gar. E. Bay & Camden. Like *Flaccidum* in leaf – ~~except~~ but only about half the size and margin perfectly smooth. Flowers about 10 pedunculated . peduncles 1 to 2 in[ches] somewhat nodding lobes of corolla oval spreading flat or nearly so broad - concave – white not yellowish – not so large as but handsomer than *flaccidum* – smell not disagreeable – plants not immediately distinguishable when out of flower – scape recumbent after flowering – flowers same time as *flaccidum*.

Crinum [a 4 cm space is left after *Crinum*, as in the previous paragraph, suggesting an intention to add a specific name at a later date] In Kidds Garden – flowers like *Australe* scape 1 foot. Leaves 15 in by 3 in – somewhat disty whole. General appearance that of *Australe* but very dwarf – pollen dryish . fruit unknown – locality unknown – perhaps *C. bracteatum*. Mr. M^cL's seedling which he calls *Careyanum* looks very like it in leaf – said to be from V D Land – it is possibly a variety of *Australe*. [Bracteatum is written in pencil beneath in a different hand.]

[End of page]

[Continues overleaf]

Amaryllis belladonna . Varieties in Sydney

1. The common short pink with narrow leaves – early
2. The broad leaved pink later
3. The broad leaved striped with very tall scape

4. The pure white variety – leaves broad – scape short – flowers larger than any of the others not fading to pink . [word indistinct, probably] capsule nearly twice as long.

[This entry written in pencil and very pale but certainly Bidwill's hand.]

Page 3

Amaryllis – Hybrids etc

A. belladonna by *Crinum scabrum*. [2cm space] No mistake can have happened in the case of this plant. I myself never could succeed in procuring the cross but recommended the experiment to E. Bowman who gave me the seeds; they appeared to be very small seeds of A. belladonna with the embryo very conspicuous but I did not at the time believe them to be raised seeds but merely accidental weak ones. Of about ten all of which grew I was only able to preserve one which for a long time was not distinguishable from the natural seedlings of A. belladonna; at the time however when those seedlings began to lose their leaves in the following summer this plant began to grow vigorously and continued to do so until the following winter when it lost its leaves at the same time with the male parent by that time the leaves had elongated greatly and had ceased to have the slightest resemblance to A. belladonna; I had thought previously to this time that it would not lose its leaves at all but that it would partake of the nature of both its parents in such a manner as to be evergreen – the vegetation of one plant commencing just when the other ceases to grow – this however was not the case after the first winter of its existence; had this habit been permanent the effect of this cross would have been the most curious with which I am acquainted. I suppose that the type of the male parent becoming more predominant in this plant as it got older was the reason

[End of page]

[Continues overleaf]

of its becoming deciduous; and that the reason why it kept its leaves during the first winter ~~of its existence~~ was that it may have been then considered ~~to be~~ supported by the vitality it derived from the fleshy mass of the seed; the leaves of the male being very tender is probably the reason why the plant was so difficult to keep alive during the first winter although afterwards tolerably robust – it was too weak to make any bulbs capable

of withstanding any period of frost in consequence of the small degree of support it derived from its matrix: for while the ordinary seeds of *A. belladonna* are as large as large peas, these were hardly larger than pin heads, and of this small bulk the embryo appeared to constitute ['form' written above] more than one half: it was in fact larger than in the pure seeds.

Oct 5/42. The plant now about 18 months old is just pushing forth its spring foliage. The bulb is oval about 1 inch high and $\frac{1}{2}$ an inch thick with a short neck, is nearly transparent and does not appear to have any peculiar external coat. Young bulbs of *A. belladonna* by *A. josephiniana* and *Brunsvigia multiflora* sown at the same time are now just beginning to lose their leaves. They are about twice as long on the average as this one but are more cylindrical in their form. Jan 17/43, Has become very like *Flaccidum* but the leaves are deeper green- 2 leaves about 18 in long $\frac{1}{2}$ in wide deeply channeled with two lines on the inside like those of *Pedunculatum* – in this it differs from *flaccidum* – margin scabrous . apex flat – appears disposed to form a column above ground.

May 25/43 at sea – One leaf only about 3 feet long – no wider than before.

I now

[For explanation of 'at sea' see notes on notebook p.28]

Page 4

begin to think that this cannot be *Flaccidum* because the double channel is becoming very conspicuous – which in *Flaccidum* I never observed it.

[End of page, most of this page blank]

[Continues overleaf]

A. belladonna by *A. Josephiniana*. this cross is easily affected – a much larger quantity of seeds are borne by *A belladonna* when impregnated by *A. Josephiniana* or *Brunsvigia multiflora* than are ever produced in a naturally impregnated seed vessel – the seedlings are not very distinguishable from the pure ones of the same plants; there are however many different looking plants among the seedlings so that we may expect considerable variety in the flowers – some are at least 5 times as large as others – some have broad, some narrow leaves – Oct 20/42. At this time their second hibernation is commencing the bulbs vary from 1 by $\frac{3}{4}$ to 3 by 1 in in size.

March 1847. Flowered at Camden – see *Amaryllis Ameliae* p7.

[1 cm space]

A. belladonna by *Brunsvigia multiflora*. These plants do not appear in general very different from the last – there are however some plants among them which have broad leaves like the male parent and one in particular which is exceedingly curious from being covered all over with long stiff hairs – this could not be derived from any of the hairy *Brunsvigias* known there are none in the country and shows that the hairy leaves of some of the specimens in herbariums may have been derived from accidental plants and may not be species – Some of the hairs are proportionally quite as long as on the specimens of *Buphane guttata* pl.22 [of Herbert's Amaryllidaceae, which shows a hairy leaf of *Buphane guttata*].

Page 5

A. Josephiniana by *A. belladonna*. *A. Josephiniana* does not bear much seed in Sydney but seed is produced just as readily by pollen of *A. belladonna* as by its own. The plants produced at the same time as those mentioned ['of *A. b* by *A. J.*' written above] are (Oct 20/42) not a quarter the size of those in the same soil and alongside one another – Oct 25. could not find one of these bulbs.

[1 cm space]

Brunsvigia multiflora – The same obs. as to *Am. Jos.* from which plant it hardly differs except in leaf – seedlings grow very slowly. I have seen a [1 word undeciphered] seedling of *B. multiflora* which at the age of three years had leaves 5 inches long and would probably flower in two years more – this was at Camden in rich stiff soil.

[End of page]

[Continues overleaf]

Ammocharis falcata – I am sure that I once had seed of this plant by *Amaryllis belladonna* but it was stolen. I can see not the slightest doubt of its mixing fully either way but this plant is so scarce here that I have had not an opportunity of trying. I can see no reason for separating the genus from *Amaryllis*.

[1 cm space]

Crinum scabrum. Thrives in Sydney – leaves spring in Sept. Flowers after Xmas: produces three scapes only (3) and bears seed ~~readily~~ abundantly: the seeds grow much more rapidly than of either of the native

Crinums. The embryo is not half as thick as that of *C. pedunculatum*. I never could succeed in getting this plant to bear seed by any other Crinum: though it has often set seed but they have invariably shriveled before maturity – it does not require any frost to lose its leaves as there is never frost in the garden at Sydney [Sydney Botanic Garden] and they are just as deciduous there as at Camden.

Jan 1843. appears to have set fruit by revolutum.

[2cm space]

Crinum revolutum. Does not lose its leaves at Sydney (see *C. Koeganense* page 1). Flowered about Xmas 1842/3 – Impregnated it by *A. belladonna*, *C. pedunculatum* and *scabrum* – capsules all swelling when I left Sydney – shape of the long capsuled varieties of *A. belladonna*. I have not seen the seed of this plant but the flower is almost exactly like that of *A. belladonna* from which plant it in fact only differs in leaves – the style is very thick and very different from that of any other Crinum I have seen – I consider

Page 6

(*Crinum revolutum*) it the connecting link between *Crinum* and *Amaryllis*.

[1 cm space]

Crinum seed in Clay

In April 1842 I enveloped a seed of *Crinum scabrum* in a coat of pipe clay so as to form a bole about two inches diameter. This I covered with varnish as soon as it was sufficiently dry on the surface to retain it without absorbing any great portion – as soon as one coat of varnish was nearly dry I laid on another so that in two or three days I had laid on about six coats. In November of the same year I broke the bole of clay – it was not cracked on any part of the surface but appeared perfectly dry throughout – in the cavity was the skin of the seed enveloping a perfect bulb [Bidwill's underlining] about an inch in diameter nearly spherical – without any dry skin, roots or appearance of connection with the seed – a small leaf appeared to be just springing from the bulb which was about $\frac{2}{3}$ ^{ds} the size of the original seed of which there was no vestige remaining but the epidermis. I took no care of the bulb consequently do not know whether this would be a good way of raising such plants or not.

[End of page]

[Continues overleaf]

Pollen of Amaryllidaceae

I have found the pollen of *Crinum*, *Amaryllis*, *Haemanthus*, *Brunsvigia*, *Nerine* & *Buphane* capable of impregnating the ovaries when two years old: and I believe that it would keep good for any length of time provided it did not mould – unfortunately mouldiness very readily appears upon it in damp weather and I have not yet found any means of preventing its access. I have not found the pollen of *Ammocharis* to keep that long but have had but little of it to try – I have not succeeded in impregnating any *Hippeastrum* with dry pollen but am inclined to attribute my failure to accident. I have only tried with one species of *Habranthus* and then I failed but still believe that the dry pollen might be rendered efficacious especially by wetting the stigma previous to the application.

Page 7

Pyrolirion aureum P184 [of Herbert's Amaryllidaceae]. Leaves sprout in Sydney as Mr. Herbert supposed in the middle of summer. Flowered in Sydney in February.

[1 cm space]

Crinum scabro-pedunculatum

Raised at Camden 1841 flowered Xmas 1844.

Bulb somewhat pear-shaped with a thick column – not naturally above ground – stained with red – leaves scabrous 4 to 5 feet long - 5½ in at broadest point – the greater portion pendulous, resting on the ground – very like *scabrum* but much more robust – scape 2 ft 6 in high – bearing 17 or 18 flowers which are sessile – tube 5 inches petals 4½ in to 5 inches – outer about 1 inch, inner 1¼ in broad – reflexed when fully expanded – shape nearly that of *pedunculatum* but broader – not elliptic like *scabrum* 8 or 10 open at once – flower when fully expanded 7½ in across – pure white with a distinct stripe rather paler & brighter than that of *scabrum* about 1 inch of the outside of the inner segments coloured like the stripe, lips green. Anthers yellow – pollen apparently perfect – filaments dark red approaching one another as in *scabrum*. A superb variety superior to either parent in almost every respect.

[The words var "Augusta" added in pencil, possibly in William Macarthur's hand. Although never formally listed in the Camden Park catalogues *Augusta* was added by hand to a Camden Park copy of the 1850 catalogue

as no.94/2, together with Cleopatra – 94/3, Helen – 94/4, Dido – 94/5, and Thisbe – 94/6, all described as varieties of scabro-pedunculatum.]
[End of page]

[Continues overleaf]

Amaryllis Ameliae or Josephini-belladonna (see p. 4) flowered in March 1847. Named in complement to Mrs James Macarthur.

Scape 18 inches high . section elliptic . spathe purplish green, rather persistent . peduncles $3\frac{3}{4}$ inch; germen triangular, angles rounded – corolla 4 inches – segments $\frac{3}{4}$ inch wide . 2 upper sepaline segments reflexed as in Josephiniana – colour purplish rose variegated with white, but turning dark after expansion – stamens $1\frac{1}{2}$ inch shorter than segments of corolla, white at base – coloured at tips – Anthers purple before bursting – Pollen hardly perceptable – Flowers disposed in a somewhat circular manner, but a little inclined to one side.

Leaves

[1 cm space]

2 plants flowered as above a 3^d with 19 flowers on a shorter scape – the flowers shorter and wider & an almost spherical germen.

Leaves of this plant [entry finishes here]

Page 8

1852 Bananas

About the middle of September I found some seeds in a banana, which I immediately sowed. There were many seeds but the greater part were imperfect.

Oct 6th [Bidwill's underlining] The first seedlings above ground looking just like a shoot of Maize of the same age. The seed was from the sort so commonly sold at Sydney. Another came up a few days after the first which appears to be variegated in the leaves.

The plants grew slowly and exactly resemble young Hedychium having the leaves somewhat distichous and lanceolate without any midrib.

Dec 24 Stem about 4 inches high. Leaves (8th) beginning to have a mid-rib which extends almost $\frac{2}{3}$ ds the length of the leaf; leaves still lanceolate but broader than formerly. Planted it out.

[End of page]

[Reverse of page 8 and the whole of page 9 blank]

Page 10

Pines 1853

1 Providence. Plant large, very spreading. Leaves very broad
 [1 cm space]

Fruit very large, broad or thick, pips rounded, dingy yellow with slight tinge of red.

2 Emille. Plant medium size, upright, makes suckers before fruiting.
Leaves medium breadth, dark red everywhere, striated, covered on upper surface with glaucous bloom. Crown small.

Fruit large, oval, slightly conical, dingy brownish yellow & red. Pips rather small, not prominent. Flesh white, juicy, not high flavoured, of moderate excellence.

3 Smooth Cayenne Plant of rapid growth, not spreading . few suckers medium size. Leaves narrow: nearly without prickles, outer mottled with red in centre of plant bright green without tinge or red.

Fruit large, cylindrical, pale yellow, with a peculiar musky odour & high flavour but acid. Pips very regular, flat

4 Black Antigua Plant large, spreading

Leaves long, narrow, reddish and glaucous in centre of pl. but quite green and without powder Frost hardy the greater part of their length, not striated

[End of page]

[Continues overleaf]

5 Black Jamaica. Plant medium size, not spreading.

Leaves narrow, reddish almost everywhere, not glaucous above, not striated.

[4 cm space]

6 Moscow Queen Plant small, spreading, makes many suckers. Leaves very strongly veined, oblique, tinged with dark red.

Fruit small, frequently misshapen . very deep yellow when ripe – dark green before, very highly perfumed & sweet.

Shape

Pips not prominent, irregular, obtuse, large

Crown small nearly double

7 Ripley Queen. Very like Old Queen but fruit perhaps larger.

Fruit medium size – (4lbs). very good shape, nearly cylindrical but slightly

rounded at the ends. Pips moderately prominent, pointed. Flesh deep yellow. Crown small

8 Montserrat Plant large not spreading

Leaves rather broad, altogether very dark red with very slight glaucescence in centre, becoming yellow when old

Page 11

Pines – continued

9 Globe

[4 cm space]

10 Green Olive

[1 cm space]

forming many suckers under Fruit small roundish conical . very green before

ripening - pips rounded moderately prominent.

[2 cm space]

11 Prickly Leaved Cayenne.

Plant large, spreading. Leaves narrow, green & slightly glaucous in centre, becoming reddish & losing glaucescence outwardly.

[3 cm space]

12 Brown Sugar Loaf

[End of page]

[Continues overleaf]

13 Old Queen

[Rest of page blank. These almost certainly represent early notes from a trial of pineapples carried out at Tinana at Wide Bay. The date of 1853 suggests that the trial was terminated by Bidwill's death.]

[Pages 12-20 blank]

Page 21

Nerine Hybrids

I once got a single seed from a Nerine by A. belladonna under circumstances when there can have been no error but I do not know if it ever grew or not: nor do I know if it differed from a natural seed of Nerine because it was the only seed I ever saw produced in NSW by any plant of the Genus. It was a regular flowered Nerine of a dark dull red

colour unknown to me by name. I never succeeded in impregnating *A. belladonna* by any *Nerine* although I have often tried. Mr McA. & EB both consider that they have.

[End of page]

[Reverse of page 21 blank]

Page 22

7. A tall variety in one of the small gardens in the Gov. Gar. column tall white or greenish – leaves very long much narrower much more upright than any other variety locality unknown.

[This entry follows no.6 on the reverse of this page]

[7 cm space]

Crinum pedunculatum does not invariably split into two parts only – several plants that I have seen have split into five in the course of one year – the one mentioned in the opposite page has 5 centres besides which three of the centres are double and will therefore again divide next year – small offsets are occasionally put forth by the large varieties in the gardens in NS Wales –

1842 Oct 15th The first flowers open this spring – one other plant will flower in a fortnight; but these are evidently too precocious for healthy development.

Moss roses in flower just now for the first time – corresponding therefore to [1 cm space left here] in England. Nov 9. All the plants showing flower.
[End of page]

[Continues overleaf]

On the varieties of *Crinum australe* in Sydney

1 There are about five varieties in Sydney. The largest is one with upright broad leaves and a column slightly coloured on one side. The lobes of the flower are broader than in the smaller varieties. I have seen one bulb of this nearly 18 inches diameter at the ground and almost 12 in high to the leaves which were 4 feet long. Believed to come from Moreton Bay.

2^d The common variety which grows at the Hunter R about half the size of the last with leaves more furrowed and flowers smaller – grows naturally in salt water marshes

3^d A variety about the size of the last with shorter and broader leaves irregularly spreading like a *Yucca* more rigid than any of the others –

Lyndhurst . said to be raised from Botany Bay seed – column very short.
4 One plant in the Government garden – leaves narrower – upright as the first one – bulb not more than 4 inches high and thick – flowers earlier than the others and appears to have fewer scapes in the course of the season. The chief difference is in the fruit which is mottled with brown and is produced in great abundance; spathe coloured reddish.

5 One patch of a very small var. in the Gov. garden . height not above 18 inches – bulb 1½ dia - flowers

[2cm space]

6 A very large var. in a garden in O'Connell Street. leaves much more spreading –under ones horizontal. Flowers through the winter.
look other side [for no.7, found at the beginning of page 22]

Page 23

Crinum pedunculatum – Hybrids

1841. I impregnated the last bunch of flowers of the season (April I think) produced on a plant growing far from any other – in fact I do not know of any other *C. pedunculatum* in flower at the time – with pollen of *Closteremma lutea* – one capsule produced two plants which vegetated next spring (October 1841), they are not pure plants of *pedunculatum*. At the time I got the seed from the plant I thought it impossible that there could be any doubt about the father; I can hardly say now that I believe it to be what it pretends although it is evidently a hybrid.

The leaves are more upright, narrower, flatter and more pointed than pure seedlings of the same age, the bulb is larger at the base and has a blackish skin. The only *Crinums* I had at the time to impregnate with were *C. scabrum* and *C. flaccidum*; the plants bear no resemblance to the cross by *C. scabrum* and their absolutely entire margins, flatness and upright habit of their leaves are against the supposition of an accidental impregnation by *C. flaccidum*. The plants are now [word not deciphered but probably] so weakly, but their leaves were cut off in the winter which is against the supposition of their being crossed by *Calostemma*, an evergreen plant in the same situation.

1843 Jan 17 – Leaves 7 longest 2 feet by 1¼ ins very gradually tapering to a point – point flat – deep green quite entire - ⅔ of the length upright the remainder suddenly

[End of page]

[Continues overleaf]

bent downwards . leaves not at all flaccid but in spite of their position very stiff and rigid in their texture – margins quite entire – plant healthy.

[12 cm space]

By Scabrum. Many plants at Camden. 2yrs old Jan 1843. Leaves broader and more prostrate than pedunculatum – undulated thin . light green . not scabrous – quite upright but spreading more than pedunculatum – Very distinctive plants . healthy

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Crinum pedunculatum – recontinued

1842 April. by Haemanthus coccineus. While I was trying this cross I did not suffer a single flower within half a mile to produce anthers. The plant seemed to have a great disinclination to produce seed with this pollen. A circumstance occurred which I had never before seen and which nearly prevented me getting seed from the flowers that were actually impregnated: the tube of the flower which generally becomes fleshy and is persistent for from one to two inches above the germen in this case continued to decay until in several instances a portion of the top germen was mortified . observing this I separated the decayed portion one hot and dry day and saved several of the fruit thereby. This unhealthy action may have had nothing to do with the artificial impregnation but I record it for future observation. I should also say that the impregnation of its flowers did not take place easily. The stigmas continued for more than a week to exude a viscid liquid which I wiped off daily before applying the pollen. The flowers were also much more persistent than usual.

Oct. 5. It is difficult to say at present that there is any difference to be observed in the seedlings, which are now almost a month old and have their leaves about 6in high – I think however that the leaves are disposed to be broader

[End of page]

[Continues overleaf]

upwards than is usual. I have no pure plant of the same age to compare with. Nov 9. these plants appear to be less cucullite at the apex of leaf than pure ones but the difference is very slight.

Jan 17/43 Plant appears more robust than [1 word undeciphered, may

be shorthand for pedunculatum] (which is a healthy plant) or than any seedlings of pedunculatum I have ever seen. Has ten leaves – longest 1 foot 1½ in wide apex of all but the inmost recurved – gave the twin to Mr M'A to take care of for me.

March 1843. Lat 37.4°S Lon 48.6°. Discovered that this plant was often without root. Planted one leaf with two young roots thinking it might possibly grow. The leaves of this plant became strongly [1 word not deciphered] with red in decaying and the lower portions of the stem stained in the same manner – this looks very like a cross. The longest leaf is 13 in long and 1⅛ wide.

Page 25

Crinum pedunculatum

1842 April By Brunsvigia multiflora. Same precautions as the last. Only one seed produced – a weakly one. Nov 9 Plant does look different from [1 word undeciphered, may be shorthand for pedunculatum] but not sufficiently to be certain as yet – plant about 4 inches high

Jan 17/43 Leaves more acute than those of [1 word undeciphered, same as previous paragraph] – tips not recurved

[End of page, rest blank]

[Continues overleaf]

1842 February. By Amaryllis belladonna. I have no reason to doubt that I have a great number of this cross.

October. Many of the seedlings are above ground but it is difficult to say in what they differ from pure plants of pedunculatum. I think nevertheless that they do differ. They all appear weakly but that may be the fault of the soil they are in.

Jan 17/43. Plants have tips of leaves recurved & more acute than the [1 word undeciphered, may be shorthand for pedunculatum].

Page 26

Tabular view of the different varieties of *Crinum australe* in Sydney.

[Note: text to the right of the table was written across left and right pages in such a manner that there is no doubt to which of the numbered plants it refers. The text to the right of the table is given below it.]

TABLE I.

Height of column	Diameter	Length of leaf	Total width outside	From edge to edge across	Number of leaves when exposed	Colour of column when exposed	Position of leaves
1	10	7	52	6 1/2	5	21	W ^{ht} with R ^{sh} stain mod spreading
2	8	6	50	3 1/2	2	20	G ^{sh} White very upright
3							
4	6	3	32	4	3 1/2	15	G ^{sh} White stiff upright
5	7	4	33	4 1/2	3	12	G ^{sh} White spreading
6	3	4	40	4 1/2	3 1/2	15	Greenish spreading
7	0	1 1/2	28	2 1/2	2	9	rather upright
8	6	5	36	4 1/2	4	16	green stiff upright
9	14	6	40(?)	4 1/2	4	20	purplish upright
10	12	5	64	5	4 1/2	20	greenish upright

26

Tabular view of the different varieties of *Crinum australe* in Sydney

Number	Height centimetres	Diameter cm.	Length of bulbous rhizome	Bulbous rhizome width cm.	Flowers bulbous	Length of bulbous rhizome	Colour of column, when exposed	Position of leaves	
1	10	7	52	6½	5	21	light yellow	nodding	Mourton Bay (?)
2	8	6	50	3½	2	20	gold white	erect upright	very remarkable
3									The variety in O'Connell street perhaps
4	6	3	32	4	3½	15	gold white	stiff upright	Botany Bay (?) differs from no. 5
5									
5	7	4	33	4½	3	12	gold white	spreading	Hunter H. The common one
6	3	4	40	4½	3½	15	greenish	spreading	only one plant miss
7	0	1½	28	2½	2	9		erect upright	one clump in S.G.
8	6	5	36	4½	4	16	green	stiff upright	2 plants long S.G.
9	11	6	40	6½	4	—	purple	upright	standing near end of tube.
10	12	5	64	5	7½	20	greenish	upright	The very long and very long 2 in

Fig. 4. Tabular view of the different varieties of *Crinum australe* in Sydney. Photographs of Bidwill's table on page 26 of the notebook. Photographs by Colin Mills.

Scrub & wet areas

Leaves often largely naked - a hill about to divide 12 inches diameter - one scurf with 7-8 leaves
 variety in Kidd's garden. leaves not at all naked at edges - scape green slender.
 inconspicuous flowers are very much smaller in the same ground
 not different from No 1 but appears to have a white column - and the leaves spread very much
 in the apparently greater breadth of leaf which remains broad like more than $\frac{2}{3}$ to the end and suddenly
 almost longitudinally pleated along
 narrow, more channeled - stiff. looking very different but diff. difficult to define
 in living. small but handsome var. external leaves droop towards their upper
 half broadest in middle when tapering commences - very rarely naked at edges
 It has slender reddish yellow stems & style much darker red than in any other var. - tube 2 $\frac{1}{2}$ in. limb 2 $\frac{1}{2} \times \frac{3}{8}$ anthers
 yellowish reddish pink etc red - leaves droop towards the upper third $\frac{1}{2}$
 leaves tapering very gradually from base thus

almost sessile

very distinct - generic very thick, scape green, upright, flowers bright outside before
 division, tube much shorter & broader than usual. tube 2 $\frac{1}{2}$ in. limb 2 $\frac{1}{2} \times \frac{3}{8}$ anthers
 yellowish pink anthers greyish brown in division. limb 2 $\frac{1}{2}$ in. tube upright before expansion
 cap long thick upright purple pink often tube 3 $\frac{1}{2}$ in. limb 2 $\frac{3}{8}$ style column in tube 2 in mouth
 white, tube 2 $\frac{1}{2}$ in. as red pink was marked

No 5. fruit in garden - scape half as long as leaves. upright 40 cm. tube 3 in very slender limb 3 $\frac{1}{2} \times \frac{3}{8}$ anthers
 white. tube 2 $\frac{1}{2}$ in. limb 2 $\frac{3}{8}$ style column in tube 2 in mouth

scrub & scrub

Fig. 5. Tabular view of the different varieties of *Crinum australe* in Sydney. Photographs of Bidwill's table on page 26 of the notebook. Photographs by Colin Mills.

The variety mentioned p. 22 as No 3 at Lyndhurst is probably the same as 4 but the leaves are almost without marginal undulation. I believe in consequence of the soil being less sandy than it is in the Gov garden all the above grown in the Gov. garden.

[This comment written across the left and right pages. The numbers below equate to the numbers in the far left column of the table.]

1. Moreton Bay (?) [Bidwill's question mark] Leaves often largely waved – a bulb about to divide 13 inches diameter . scape very short – curved one scape with 72 flowers
2. A very unremarkable variety in Kidds garden. Leaves not at all waved at edge – scape green, slender . in comparison the flowers are much smaller in the same ground
3. The variety in O'Connell Street perhaps not different from No 1 – but appears to have a white column and the leaves spread very much
4. Botany Bay (?) [Bidwill's question mark] differs from No 5 in the apparently greater breadth of leaf which remains broad till more than $\frac{3}{4}$ to the end and suddenly narrows – more channeled almost longitudinally plicate at apex – stiffer . looking very different but diff. difficult to define
5. Hunter R. The common one in Sydney. Small but handsome var. external leaves disposed to drop towards their upper third broadest in middle when tapering commences – very rarely waved at edge.
6. Only one plant in G. G. scape slender reddish 40 flowered spathe stained reddish – fruit dk red stamens and style much darker than in any other var. stigma 3 lobed . leaves disposed to droop towards the upper third
7. One clump in G. G. leaves tapering very gradually from lower third
8. 2 plants Conn G. G [probably O'Connell Street & Government Garden]. Very distinctive – germen very thick almost spherical scape green, very upright. Flowers purplish outside before expansion . looks much shorter and broader than usual – tube $2\frac{1}{2}$ in, limb $2\frac{1}{2} \times \frac{5}{8}$ anthers very short ($\frac{1}{4}$ in) anthers grayish before expansion . tube slender & peduncle stiff . upright before expansion
9. Standing near 6 scape long – thick upright – purple below 40 flowered . tube $3\frac{1}{2}$ ins – limb $2\frac{3}{4} \times \frac{3}{8}$. style coloured 1 in below the mouth of tube. I did not think this the same as No 1 but was mistaken
10. The very long leaved variety – finest in garden – scape half as long as leaves . upright 40 flowered . tube $3\frac{1}{2}$ very slender . limb $3\frac{1}{2} \times \frac{3}{8}$ anthers very long ($\frac{3}{4}$ in) some of the sepaline lobes have frequently a thread of

purple running through them.
(Fig. 4 and Fig. 5).

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The foregoing Crinums differ greatly in stature and general appearance of the leaves although growing in the same ground – the flowers do not differ much in general appearance. The smallest flowered variety is No 1 and the largest No 10.

The two most desirable ones are Nos 1 & 10 – 1 because it has such an enormous umbel of flowers and 10 because of their great size – 1 is also desirable because of its breeding more readily with other Crinums than any other variety I have tried when every other plant has failed I have tried No 1 with immediate success. I tried this season (1842 – 1843) thru several plants with Americanum impregnating the whole of flowers of each umbel but did not produce one seed – I afterwards tried No 1 and almost half of the germens appeared to be swelling when I left them. The like took place with Ammocharis falcata with which pollen I tried about 7 umbels without success until it came to the turn of No 1 . on this plant also I raised the seed which I have by Buphane distypha & Nerine curvifolia this year (1842/3) & last year Amaryllis Belladonna – on the umbels appropriated to these crosses every flower impregnated produced seed – on the same plant however I have tried Calostemma without success. From No 3 I have never been able to produce a single seed by any pollen I have tried – whether Crinum pollen or that of any other Amaryllidous plant.

No 6 is a very unremarkable variety with a red scape and dark red fruit & peduncles a very short column and spreading leaves – increase only by division – it has decidedly a 3 lobed stigma.

No 2 is also a most curious variety with very narrow stiff upright leaves and rather small flowers.

No 8 increases very much by offsets . both plants being entirely rimmed by them - also the large varieties occasionally throw off a smaller offset in Sydney.

[End of page]

[Continues overleaf]

I have observed that no one bulb of Crinum produces more than three scapes in a season unless it shall have several centres which are about to

become separate plants – this is also the case with *C. scabrum* in N S Wales.
I am not certain that *Flaccidum* produces so many.

[Rest of page blank]

Page 28

Crinum australe - hybrids of 1842 – 3 [double score through is Bidwill's]
By *Nerine curvifolia* – a great number of seed of No 1. almost every flower
set seed – anthers removed from every other plant in the garden at the time
– no doubt.

By *Buphane distycha* – off No 1 also – no doubt

By *Ismene Amancaes* – I am not certain that these crosses were not
produced by some other pollen but that I forgot to remove the label

By *Crinum revolutum* – seed just set when I came away

Crinum scabrum

By *C. revolutum* – seed apparently set

Crinum revolutum

By *C. pedunculatum* seed growing rapidly

Crinum (see page 2)

By *C. revolutum* 1 just set

I left all these in the garden when I left Sydney

[Bidwill left Sydney for an extended stay in England, arriving on June
12th 1842, and returning to Sydney on March 23rd 1843. There are two
references to this journey in the notebook, page 3, 'May 25/43 at sea', and
references to Latitude and Longitude in March 1843 on p.24.]

[End of page]

[The reverse of page 28 and the whole of page 29 are blank]

Page 30

Calostemma

1. *C. lutea*

[1 cm space]

2. *C. purpurea*

[1 cm space]

3. *C. purpurea* – minor – smaller flowers – much larger [word indistinct
possibly] bracteas which are very persistent & green – an obscure variety of
no great beauty

4. *C.* [3 cm space] much deeper and more uniform yellow than *C. lutea*

— not near so handsome. ~~The same bulbs throw up scapes bearing pink flowers — but I have never seen pink and yellow flowers on the same scape — the pink scapes come after the yellow ones and form few seeds — the pollen is scarce.~~

5. *C. carnea* (Mitchell) ~~I suppose the same as the last.~~ Pink — often throwing up yellow scapes from the same root — the flowers are never of two different colours on the same scape

6. *C. [3cm space]* The handsomest species of *Calostemma* I have seen — colour of *C. purpurea* — flowers larger — sepals & petals spreading much so as to look wavy — cup white red at base — leaves shorter and broader than in *C. purpurea* — Nov 10/42 leaves quite dead

7. *C. alba* (Mitchell) I do not believe in the existence of this plant . it was probably *Eurycles australasica* — its flowering in December and being sweet scented are greatly against its being a *Calostemma*. *Eurycles* flowers at Xmas — *Calostemma* not for 2 months later.

[End of page]

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8. *C. [3 cm space]* The bronze *Calostemma* — smells more strongly of peppermint than any other species.

[6 cm space]

All *Calostemmas* appear to thrive best in sand - in stiff garden soil the flowers never look much but decay early on the scape — the best way of having a good bloom is to put them in sandy soil made very rich and kept very moist - treated this way they will probably flower in two years from seed if not suffered to lose their leaves. I have no doubt *Eurycles* and *Calostemma* will breed together — I have some doubt whether Nos 4 & 5 are different or not — the pink plant has less pollen than any other sort and bears fewer seeds.

Nov 10/42 At present many of the *Calostemmas* have entirely lost their leaves but I do not know if they do so in moderately moist seasons — the most properly deciduous are *Lutea* and No 6 the least *C. purpurea*
I have raised a great many hybrid *Calostemmas* which may be expected to flower in Jan 1844

I have some seedlings from flowers to which I applied the pollen

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of Ismene Amacaes but when I saw the plants last it was impossible to say that they were different from the other seedlings.

I crossed species of Calostemma with each other species using each species both as male and female so that I ought to have at once 42 new varieties. A great many of the seedlings were very weakly.

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Crinum flaccidum

Is a very poor plant in the sandy ground at Sydney the scapes are not more than 12 inches high, lax. with about 5 flowers – at Camden in strong garden soil they grow 2½ feet high and are quite upright.

The flowers are half as large again and form a large handsome umbel of about 12 flowers (perhaps more) – At Camden it always loses its leaves in winter but not at Sydney.

[4 cm space]

Hybrids

1. by *C. scabrum* [3 cm space] raised in 1841 – given to E. B. leaves resembling the male - deciduous – leaves sprouting Oct 1842

Flowered Dec 1844. seeds freely

[4 cm space]

2. by *Pedunculatum* – numbers flowered at Camden 1844-5 – a poor cross leaves long – smooth – tapering regularly – greater part pendulous – not flaccid – flowers white much the shape of *Flaccidum*

[The reverse of page 47 and pages 48 and 49 blank]

Page 50

On certain genera of Amaryllidaceae belonging to the division "Amaryllidiformes" of Herbert –

I have never been able to discover the grounds for making separate genera of *Crinum*, *Amaryllis*, *Brunsvigia*, *Buphanes* & *Ammocharis*; and am of opinion that the whole should be united ---- to begin with *Crinum* & *Amaryllis*. I will for this comparison take *A. belladonna* as the exemplification of the genus: supposing that the relation of that species to the others is universally admitted. On making this comparison I find that

the only difference which is not merely a difference in degree is that the leaves of *Crinum* are convolute in aestivation and that they are not so in *Belladonna*: in both genera they are tubular at base.

Now if the plants called *Haemanthus* but having sheathing leaves are really species of *Haemanthus* this difference is not sufficient to constitute a genic difference between other plants of the same family – *Crinum* has generally a long tube; but this as Mr. Herbert says is a variable feature, and I find accordingly that the tube of *C. revolutum* is hardly larger than that of *Belladonna* – between the two plants I can see no difference except in leaf and time of flowering and if the genus *Crinum* should be abolished these plants would follow one another very naturally as *A. belladonna* & *A. revolutum* – I regret that I have had no opportunity of examining observing the ripe seed of *Revolutum* but the immature capsule strongly resembles that of *Belladonna* at the same age. The chief difference between seeds of *Crinum* (Fig. 6)

[End of page]

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and *Belladonna* is in size: seeds of *Crinum* are often very large and of *Belladonna* rarely larger than a pea but I have had occasional seeds of *C. pedunculatum* not larger than peas and once saw a seed of *Belladonna* nearly an inch across. The transparency of the seeds of *Belladonna* is peculiar to itself for the seeds of *A. Josephiniana* are as opake [sic] as those of any *Crinum*, while those of some of the Australian *Crinums* confounded under the name of *Flaccidum* are nearly as watery as those of *Belladonna*. Supposing *Brunsvigia multiflora* to be the correct type of the genus I am totally at a loss to imagine how it can be separated from *Amaryllis*. The capsule of *Josephiniana* has its sides puffed out so as in some measure to destroy its triangularity while the capsule of *Multiflora* being twice as broad the angles are very distinct: there is not the slightest difference in the texture of the two capsules: they both appear perfectly membranous when dry and do not then show any appearance of a papery coat, which is however sufficient perceptible at an earlier stage especially if the weather is rainy at the time – the seeds of the two plants are precisely similar and the flowers are so much alike that it is difficult to point at any difference except that the lower part of that of *Josephiniana* is marked with irregular brownish spots which are absent in *Multiflora*. Both plants are shy seed

bearers and as I have often been unable to get seed from either of them by artificial impregnation with their own pollen it is not wonderful that Mr. Herbert should have

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failed to produce a cross between them – In some seasons or in particular climates I dare say

the cross might be easily produced. * see p.282 where Mr. Herbert hints his suspicions of this genus. [Note obviously added later, the words written in pencil although with the same hand.]

Had I seen only Buphane distycha I should have been inclined to think that the affinity of the genus was closer to Haemanthus than to Brunsvigia: but B. toxicaria is nothing but a Brunsvigia with an attenuated inflorescence; the capsule is hardly more membranous than that of Brunsvigia multiflora: and the seeds are almost precisely similar to those of A. belladonna. I therefore consider that the genus should be reunited to Amaryllis, with which I have no doubt it would breed. In a climate without frost in winter B. toxicaria keeps its leaves for an indefinite period – I have known a plant which has not flowered in constant growth for three years – the leaves suddenly wither just before the plant flowers which is generally in the middle of summer or about the time that the leaves of A. belladonna die. B. distycha sheds its leaves early in the summer – and immediately throws up its scape. B. ciliaris I have not seen in flower.

Ammocharis falcata (I have never seen Coranica) has the flower of Belladonna, the capsule of B. multiflora and the seed of Crinum; the leaf is peculiar but it does not differ more from that of Belladonna than does the leaf of Multiflora. I have never been able to impregnate Belladonna by Falcata: but I ascribe my failure to the circumstance of the pollen of Falcata so speedily decaying – in every instance, I have

[End of page]

[Continues overleaf]

observed, it has turned brown and become confluent within a few hours after the expansion of the flower: but this may not take place in all climates. This plant does not lose its leaves in winter in a temperate climate like that of the Cape and flowers about December Midsummer: previous to flowering its leaves wither. I had once several capsules of this plant

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On certain genera of Amaryllidaceae belonging to the division
"Amaryllidiformes" of Herbert.

I have never been able to discover the grounds for marking separate genera
of *Cinnum*, *Amaryllis*, *Bronsvigia*, *Baphana* & *Haemanthus*; and am
of opinion that the whole should be united. — To begin with *Cinnum*
& *Amaryllis*. I will for this comparison take *A. belladonna* as the
exemplification of the genus: supposing that the relation of that species
to the others is universally admitted. On making this comparison I
find that the only difference which is not merely a difference in degree
is that the leaves of *Cinnum* are conduplicate in aestivation and that they
are not so in *Belladonna*; in both genera they are tubular at least
now if the plants called *Haemanthus* but having sheathing leaves are
really species of *Haemanthus* this difference is not sufficient to
constitute a generic difference between other plants of the same
family. *Cinnum* has generally a long tube; but this as Mr. Herbert
says is a variable feature, and I find accordingly that the tube of
C. evolutum is hardly longer than that of *Belladonna* — Between
the two plants I can see no difference except in leaf and time of flowering
and if the genus *Cinnum* should be abolished these plants would go into
another very naturally as a *Belladonna* & a *evolutum*. — I regret that
I have had no opportunity of examining the ripe seed of *evolutum*
but the immature capsule strongly resembles that of *Belladonna*
at all. — The st. with its lvs. as I found

Fig. 6. On certain genera of Amaryllidaceae belonging to the division of Amaryllidiformes of Herbert. Page 50 of the notebook.
Photograph by Colin Mills.

impregnated by Amaryllis belladonna but they were stolen when just ripe
and I have never had another opportunity of trying to cross it.

[The whole of the entry ‘On certain genera of Amaryllidaceae’ appears to
be a finished document, possibly written with a view to publication, in The
Gardeners’ Chronicle perhaps.]

[Pages 52 to 93 are blank]

JOHN CARNE BIDWILL AND *xAMARYGIA PARKERI*

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INTRODUCTION

John Bidwill arrived in Sydney in late 1838 and spent the next 15 years in the colony of New South Wales, with long sojourns in New Zealand, Tahiti and Britain during this time. He also made numerous field trips and paid lengthy visits to the homes of friends William Macarthur, Edward Bowman and Philip Parker King. He died at Tinana, in the northern NSW district of Wide Bay (now in Queensland) on the 16th of March, 1853. Bidwill's life in Australia and his botanical and horticultural achievements are summarised by, among others, D. A. Herbert (1968), Mabberley (1996, 2000), Blake (2002) and Maiden (1903).

The purpose of this paper is to discuss his work with *Amaryllis belladonna*, in particular hybridising experiments with species of *Brunsvigia*, by reference to his letters to The Gardeners Chronicle of London but particularly through his recently discovered and previously unpublished notebook.¹

Bidwill may have been acquainted with the pioneer bulb hybridist William Herbert before embarking for Australia; he was certainly a regular correspondent until Herbert's death in 1847. He possibly learned his hybridising skills from him as well as from Robert Pince, a well known nurseryman and near neighbour of Bidwill's at St. Thomas', Exeter. Herbert (1844) wrote of Bidwill:

The Gladiolus called Gandavensis by Mr Van Houtte, of which he is stated to possess the whole stock, was raised abundantly by me, being the produce of G. oppositiflorus by Natalensis, but it did not thrive as

¹ The notebook was discovered during a search for William Macarthur's botanical library, dispersed in 1969/70, and much of it now held in the Special Collection of the National Herbarium, Canberra, ACT, Australia. The notebook was bound, probably at the behest of William Macarthur, into a single volume with a first edition of William Herbert's Amaryllidaceae, the latter signed on the flyleaf J. C. Bidwill, Sydney, 1840. The combined book is inscribed on the spine Herbert on Bulbous Plants. The handwriting of the notebook, with a few exceptions, is unmistakably that of Bidwill.

those raised in Belgium. Some, however, which were raised as early by Mr. Bidwill in this country, and taken by him to Sydney, far exceeded the Belgian plants in growth and vigour, and the roots thereof brought back by him from thence flowered with greater strength than those for which I am indebted to Mr. Van Houtte. (Herbert W., Gard. Chron. 1844).

Bidwill's hybridisation work covered a wide range of ornamental plants and some plants of food value. As much of his work was carried out in the gardens of friends, particularly William Macarthur² of Camden Park, it is sometimes difficult to determine if a particular cross was effected by him or one of his friends. Notable in this regard is *Erythrina x bidwilli*, of which Herbert (1847) wrote:

This plant was sent to me at Spofforth [where it first flowered in England] by Mr. Bidwill from Sydney. I am not sure whether it was raised by himself or by Mr Macleay. It is a hybrid production, from *E. herbacea*, impregnated by *E. cristagalli* [...] remarkable as being, I believe, the only certain hybrid Papilionaceous plant we have. (Herbert W. Bot. Reg. 1844).

It was actually raised by William Macarthur at Camden Park and named by him *E. camdeni*. Bidwill had requested that it be called *E. macarthuri*.

Much of Bidwill's hybridisation work is virtually unknown or uncredited but none has generated as much interest and controversy as his claims to have raised intergeneric hybrids involving *Amaryllis belladonna*, *Brunsvigia josephinae* and a species called by him *Brunsvigia multiflora*, now called *Brunsvigia orientalis* (L.) Ait. ex Ecklon (synonyms: *Brunsvigia multiflora* Ait., *B. gigantea* Heist., *Amaryllis orientalis* L.) Herbert described this species under the name *Brunsvigia multiflora* in his monograph Amaryllidaceae, referring to Heister and to Gawler's description of *Brunsvigia multiflora* in Curtis's Botanical Magazine t.1619 of 1814.

Herbert's Amaryllidaceae was well known to Bidwill; he had owned a copy² Mabberly has speculated that much of Bidwill's work was carried out at Emmeline Parker's property, 'Clovelly', Watson's Bay, Sydney. This may well be so but the only locations mentioned in his notebook are the Government Garden (now Royal Botanic Garden, Sydney) and Camden Park. He was a regular visitor at the latter, his visits recorded by Emily Macarthur: 2 in 1840, 3 in 1841, 2 in 1842, 1 in 1843, that year spent largely in England, 5 in 1844, 0 in 1845, much of that year and 1846 spent in Tahiti, at least 2 in 1846 but not recorded by Emily, 12 in 1847 and 2 in 1848, the year he left for Wide Bay. These visits lasted from less than one day to several weeks.

since 1840 and repeatedly cross-referenced it in his note book.

Most late 19th and 20th Century commentators considered Bidwill's crosses to be fore-runners of the multiflora *Amaryllis* hybrids. These are characterised by their vigour and hardiness, a large number of flowers per scape, sometimes twenty or more compared with ten or less in *A. belladonna*, often more vivid colours than *A. belladonna*, although ranging from white to almost crimson, a characteristic yellow to almost orange throat, and, often, broader segments with more rounded apices.

Such hybrids have been given a number of names since they first appeared around 1866, including *Brunsdonna multiflora* Hort., *Amaryllis multiflora* Hort., *Amaryllis x multiflora* Hort., *Brunsvigia x baptistii* Hort., *Brunsdonna* van Tubergen, *xBrunsdonna parkeri* (W.Watson) Worsley, *x Brunsdonna x bidwellii* Worsley (1926) and *Brunsvigia x parkeri* (W.Watson) Traub. The horticultural names were not validly published and the others listed here are illegitimate, that is they do not conform to the International Code of Botanical Nomenclature (Vienna Code).

W. Watson (1909) proposed the name *Amaryllis parkeri*, for the Kew Belladonna, again invalid, and Ciferri & Giacom.¹ (1950) proposed *xAmarygia* as a name for all *Amaryllis* L. x *Brunsvigia* Heist. hybrids. Moore¹ (1975) proposed the combination *xAmarygia parkeri* as the specific name for all such crosses with *Brunsvigia josephinae* (Redouté) Ker-Gawl. as a parent and under the Code of Botanical Nomenclature such crosses are now correctly called *xAmarygia parkeri* (W.Watson) H.E.Moore, at least until the origin of the multiflora *Amaryllis* hybrids is fully elucidated. Throughout this paper I have used either multiflora *Amaryllis* or *xAmarygia parkeri* as a descriptor for such plants unless discussing the work of a particular author.

Bidwill's own letters and notes, containing detailed descriptions of his hybrids, clarify his involvement in the history of these plants.

AMARYLLIS BELLADONNA X BRUNSVIGIA SPS.

It seems likely that Bidwill's interest in Amaryllids stems from his early contact with Herbert, whom he visited on his brief return to England in 1843. Bidwill (1850) wrote, in answer to a letter in *The Gardeners Chronicle*:

I formerly had a great fancy for Amaryllids, but I have lost the greater part of my interest in them since the death of Dean Herbert, as I now

have no person having a like interest to whom I can communicate my results. [...] In Herbert's "Amaryllidaceae", p. 278, mention is made of some seedlings raised from *Amaryllis blanda* and *A. Josephiniana*. In 1843 Mr. Herbert had the kindness to give me one of his bulbs, which was then, he told me, 20 years old, and was not so big as a goose's egg. It would not, in all probability have flowered in 20 years more; in a more suitable climate, such as that of my present residence, it would probably have flowered in four years, but it was destroyed by accident. I never saw *A. blanda* in flower, and now only possess two seedling bulbs, given to me by Mr. Herbert, which are expected to flower this season. If it should flower, I will repeat Mr. Herbert's experiment, and also raise crosses between it and *Belladonna*.¹

Except for a short spell of a few months as Director of the Sydney Botanic Garden Bidwill had no permanent garden of his own until he went to Wide Bay in 1849, and it is likely that Herbert's bulbs of *Amaryllis blanda x Josephiniana* and of *A. blanda* were planted at William Macarthur's garden at Camden. They were both first listed in the Catalogue of Plants grown at Camden in 1845 and were still listed in 1850 and 1857.³ The later listing does not preclude *A. blanda-Josephiniana* being lost at some time before as the catalogues were neither complete records of plants grown nor necessarily up to date.

It seems unlikely that Bidwill ever effected the cross discussed in his letter, although he could have taken the bulbs with him and planted them in his Tinana garden. He was at Wide Bay by late 1849, appointed Crown Commissioner and very much involved in the day to day affairs of his Commissionership. The above letter, published in July, 1850, although with no address, was probably written from his Tinana home.

In the 1830s and 40s there was not general agreement about the classification of bulbs in the family Amaryllidaceae. The older botanists in particular tended to follow Linnaeus in placing most species in the genus *Amaryllis*, and it was not until the publication of Amaryllidaceae by William Herbert in 1837, the first detailed monograph of the family, that any sort of consensus started to emerge, if only slowly. Herbert considered *josephinae* [*Josephiniana*] to belong to *Amaryllis*, although with a very close affinity to *Brunsvigia*. In this Bidwill followed his mentor and in

³ Four Catalogues were published in 1843, 1845, 1850 and 1857, with a fifth, c.1861 and incomplete, in manuscript form in the Macarthur Papers, Mitchell Library, Sydney. Copies of all the catalogues are held in the Camden Park archives and by the Mitchell Library.

much of his writing refers to *Amaryllis josephinae*. Herbert considered that *Amaryllis josephinae* also had a great affinity with *Amaryllis blanda*, indeed this was his principal reason for placing this species in *Amaryllis*:

It will be remembered that in my Appendix I stated the great affinity of this plant [*Amaryllis josephiniana*] to *Amaryllis blanda*, and the difficulty I found in dealing with the genus *Brunsvigia*. At that time I did not possess this species, excepting a small seedling from the Malmaison bulb, which, though above twenty years old, is not yet bigger than a fowl's egg. I have since obtained four seedlings from *Josephini*, impregnated by *A. blanda*, and failed at the same time to obtain any by impregnating it by *B. multiflora*. This is decisive as to *Josephiniana* being an *Amaryllis*, and leaves a probability that the *Brunsvigia* of Heister may yet be upheld. *Blanda* has a strong midrib to the leaves, which sheath above ground; *Josephini* no midrib or sheathing: the seedlings sheath and have a midrib, though much less conspicuous than that of *blanda*.¹ (Herbert, W. 1837).

The plant known to Herbert as *Amaryllis blanda* had apparently disappeared from cultivation by 1882 although a seedling of the original Kew Belladonna was given this name by Worsley in 1928. This loss is a great pity because study of this plant, including hybridisation experiments, may well have thrown considerable light on the nature of *xAmarygia parkeri*. It has been hypothesised that *Amaryllis blanda* was a naturally occurring hybrid and this is discussed later in the paper.

VARIETIES OF AMARYLLIS BELLADONNA GROWING IN SYDNEY.

Bidwill described four varieties of *A. belladonna* growing in Sydney and presumably used one or more of them in his hybridisation work, although he does not specify which.

1. The common short pink with narrow leaves – early
2. The broad leaved pink - later
3. The broad leaved striped with very tall scape
4. The pure white variety – leaves broad – scape short – flowers larger than any of the others not fading to pink, [word unclear but probably capsule] nearly twice as long.¹ (Bidwill, Notebook p.2).

These descriptions are broadly consistent with naturally occurring varieties, which vary in colour from deep rose-pink to white, some having more or less distinct striations on the segments (Figs. 1-4). (Rice et al,

1950.; Creasey, 1937). The pure white variety is of particular interest. Although this note is undated it was almost certainly written in the early 1840s and may be the first reference to a pure white-flowered *A. belladonna*. Bidwill distinguishes it from *Amaryllis blanda*, considered by most botanists, including Bidwill, to be a separate species, which is described as white, fading to pale blush pink. He apparently never saw it in flower. Bidwill may also have included other species, such as *Hippeastrum*, in this list. Given their very different characteristics this is perhaps unlikely although they were still commonly classified as *Amaryllis* at the time.

But before considering Bidwill's notebook further it will be helpful to review the published work on the multiflora *Amaryllis* hybrids.

REPORTED ORIGIN OF *xAMARYGIA PARKERI*.

In September 1875 The Gardeners Chronicle of London reported:

We are informed that the Amaryllis exhibited by Mr. Boivell, gr. to Sir H. W. Parker, at the Royal Horticultural Society on August 18, is a seedling raised by Lady Parker in Australia from a cross between *Amaryllis Belladonna* and *Brunsvigia Josephinae*. This cross was first effected by the late Mr. Bidwill, and has since been several times repeated by Lady Parker. Some of the seedlings so raised were superior, both in the number and colour of the flowers, to the specimen exhibited on the 18th.¹ (Anon, 1875).

As this is the first record of a flowering specimen in Britain it is unfortunate that no description is given. In 1889 a plant said to be identical to it and also from the garden of the late Lady Parker, was given to Kew Gardens by Mrs. Arbuthnot who had purchased the Parkers' Richmond home. In 1898 W. Watson described this plant in some detail under the heading 'The Kew Belladonna Lily':

This is far superior to all other known varieties of the Belladonna lily. It was supposed to be a hybrid, *Brunsvigia Josephinae* being the other parent, but no trace of the characters of the latter can be found in it beyond the large number of flowers in each umbel⁴. [...] The Kew variety has leaves 2 inches wide, a scape 3 feet long and 1½ inches in diameter at the base, and an umbel of twenty or more flowers which are nearly all open together as in the Jersey Lily (*Nerine sarniensis*).

They are larger and have broader, less pointed segments than the

⁴ Watson revealed in an article in 1909 in The Gardeners Chronicle, p.92, that J. G. Baker had expressed the opinion that there was no trace of *Brunsvigia* in the hybrid.



Amaryllis Belladonna

Amaryllis Belladonna

Fig. I. *Amaryllis belladonna* L. *Les Liliacées* 3:pl.180. 1807. Plate by P.J. Redouté. This form of *A. belladonna*, with pale pink flowers deepening with age is the most usual form found in NSW. Figure courtesy of the Biodiversity Heritage Library.



Fig. 2. *Amaryllis belladonna* L. Curtis's Botanical Magazine t.733. 1804. A typical striped form. Figure courtesy of the Biodiversity Heritage Library.



Fig. 3. *Amaryllis belladonna* L. Nuova Varieta di *Amaryllis belladonna*. Bulletino della R. Societa Toscana di Orticoltura IX:p.16. 1895. 'New' varieties of *A. belladonna*, demonstrating the variety of petal shape and colour to be found in garden populations. Image courtesy of Australian National Herbarium Library, Canberra, ACT, Australia.



Fig. 4. *Amaryllis belladonna* L. naturalised amongst native grasses and *Ixias* at Camden Park. Photograph by Colin Mills.

type [*Amaryllis belladonna*], and their colour is bright rose-crimson, changing to almost pure crimson with age. [...] Bulb fanciers generally who have seen this plant at Kew agree in calling it the handsomest of all outdoor bulbous plants.²

What seems to be a very similar plant had been exhibited in Sydney in 1866:

Amaryllis hybrid. This is an exceedingly ornamental flowering bulb, flowers scarlet and very numerous; the stem rises near two feet from the ground. The subject is from a specimen furnished by Mr. Silas Sheather of Parramatta, and valued by him at one guinea per plant.² (Sheather, 1866). (Fig. 5).

John Baptiste and other nurserymen introduced *Amaryllis* hybrids, of which Sheather's plant is probably an example, into the Sydney nursery trade around this time but their origins are unknown.

The earliest colour image of a plant purported to be an *Amaryllis* hybrid that I have seen is a water colour painted by Miss Fletcher in 1866² (Fig. 6). She was schoolmistress at the Menangle School, on the Macarthur's Camden Park estate. Three flowering plants are depicted, *Fuchsia* cultivars 'Rifleman' and 'Empereur' and an *Amaryllis* hybrid. The *Amaryllis* depicted is very pale pink with a deeper throat, with orange-yellow tones. Seventeen flowers are depicted in the scape, all at much the same state of openness. The segments appear quite broad, reflexed at the tips and with somewhat wavy margins. A very similar variety grows in the gardens of Camden Park today (Fig. 7). The front of the painting is inscribed 'To Mrs. Sanderson from Miss Fletcher, Sydney, NSW, 1866'. A note on the back of the picture records it as being the first *Amaryllis* hybrid to flower at Camden Park.⁵

Although the picture is a colour wash and the component plants apparently not drawn to scale, there seems no reason to doubt that it depicts an early multiflora *Amaryllis* hybrid. If Silas Sheather's scarlet-



Fig. 5. *Amaryllis* hybrid. Silas Sheather. Horticultural Magazine of NSW p.65. 1866. This line drawing is probably the first published figure of a multiflora *Amaryllis* hybrid. The flower is described as scarlet.



Fig. 6. Miss Fletcher's hybrid *Amaryllis*. Water colour in the collection of the Mitchell Library, Sydney, NSW, Australia. SV/Bot-AUS27. The earliest colour depiction of a multiflora *Amaryllis* hybrid I have seen. Published courtesy of the Mitchell Library.



Fig. 7. *xAmarygia parkeri* (W.Watson) H.E.Moore. Pale pink form growing at Camden Park, very similar to the flower depicted by Miss Fletcher. Photograph by Colin Mills.



Fig. 8. *Amaryllis blanda* Herb. Curtis's Botanical Magazine t.1450. 1812. This plant shows a strong resemblance to *xAmarygia parkeri*. Figure courtesy of the Biodiversity Heritage Library.



Fig. 9. *xAmarygia parkeri* (W.Watson) H.E.Moore. Pure white form growing at Camden Park. The more belladonna-like forms growing with it, with deep yellow-orange throats, still show signs of hybridity. Photograph by Colin Mills.



Fig. 10. *xAmarygia parkeri* (W.Watson) H.E.Moore. Pure white form growing at Camden Park. This form is distinctly different from Fig. 9, with more reflexed, crinkled segments. Photograph by Colin Mills.

flowered plant is also accepted at face value then at least two varieties were present in Australia by 1866, markedly different in colour. By the early 20th Century very similar plants were grown in New Zealand, with one specimen flowering in 1911 in Britain. It was again said to be a bigeneric hybrid between *Brunsvigia josephinae* and *Amaryllis belladonna*. It was described as ‘practically synonymous with Amaryllis Belladonna Kew variety, but the flowers [of the New Zealand plant] possess more of the lovely orange yellow shade [at the base of the segments]. In this respect it may be regarded as an improved Kew variety.’²² (Anon. 1911)

The descriptions of these four plants are so similar, as are the photographs accompanying the 1898 and 1911 notices and the line drawing and painting of 1866, that it is very likely that they represent the same cross, although not necessarily made at the same time. But there are direct connections between the people and the locations concerned. Bidwill’s connection with Emmeline Parker is a strong one. She was William Macarthur’s younger sister and it is likely that Bidwill carried out some of his hybridisation experiments in her gardenⁱⁱ. Silas Sheather was a gardener at Camden Park for some years before opening his own nursery on Macarthur land at Parramatta in the 1840s. He was an accomplished hybridist in his own right, particularly with camellias, in later years. John Bidwill had direct connections with New Zealand, his brother settling in the North Island in the 1840s on John’s advice. It is possible that the New Zealand hybrids originated with him, although I have no evidence of this. Finally Miss Fletcher’s painting is of a plant growing at Camden Park.

I can conclude that the *xAmarygia parkeri* hybrids originated in Australia with, possibly, a parallel development in New Zealand.

Worsley (1928) raised the possibility that hybrids such as *xAmarygia parkeri*, called by him *Brunsdonna*, could have occurred in their natural habitat and that such plants as *Amaryllis blanda* Herb. (Fig. 8) were no more than naturally occurring hybrids.

But if hybrids in this class [*Amaryllis* x *Brunsvigia*] have been raised in gardens, it is more than probable that similar hybrids have arisen fortuitously in the natural habitat of these bulbs in South Africa. Such hybrids would breed in again with their parents, and would produce a mixed race bearing some of the characters of Brunsdonna. This does take place in our gardens, where I have found that the pollen of *A. Belladonna* is strongly prepotent on the stigmas of Brunsdonnas.

However, Creasey (1939) has pointed out that hybrids are unlikely to be found in nature:

While it is noteworthy that *Callicore rosea* [Link. = *Amaryllis belladonna* L.] has not yet been crossed with any non-African amaryllid, the fact that the plants with which it has been hybridised by man do not grow within its own geographical area of natural distribution is also a matter of interest. The *Brunsvigias* and *crinums* are natives of the eastern and north-eastern localities of summer rainfall.

Creasy is not strictly correct in this assertion. *Amaryllis belladonna* and species of *Brunsvigia* do share common ranges in parts of the Cape so Worsley's suggestion cannot be discounted.

Worsley (1928) goes on to describe the reappearance of *Amaryllis blanda*, having twice been lost to cultivation, in Herbert's lifetime and after 1882.

[...] it reappeared this autumn as a self fertilised seedling from Brunsdonna Parkeri, and was given an Award of Merit at the R.H.S. on September 11 under the name of *Amaryllis (Brunsdonna) blanda*. This occurred in my garden, and of the two seedlings which flowered the one not exhibited was similar, but did not carry such a fine scape. The parentage is, in this instance, beyond doubt, and may be traced back to the original B. Parkeri distributed by Mrs. Arbuckle in 1889.

White or pale blush seedlings are not uncommon in collections of multiflora *Amaryllis* that are allowed to freely seed. At Camden Park there are four distinctly different white forms and several with pale blush flowers (Figs. 9 and& 10).

The bigeneric hybrid illustrated in The Gardeners Chronicle in 1909 and raised by van Tubergen's nursery with *Brunsvigia josephinae* as the female parent and *Amaryllis belladonna* as the male (*xBrunsdonna tubergenii*) (Fig. 11), must also be considered in this review (van Tubergen, 1909). Relying on his knowledge of the Kew Belladonna and the published figure of van Tubergen's plant⁶, Watson (1925) concluded that they were very closely related, but because of doubts about the parentage of the former:

to settle the question, we crossed *Brunsvigia* ♀ and the Belladonna at Kew, and we have now bulbs from this cross, none of which, however, has yet flowered. I see no reason now to doubt that the Kew

⁶ Elwes identified Th. Hoog as the breeder of *xBrunsdonna tubergenii*. H. J. Elwes, *The Gardeners' Chronicle*, 6th February [1909].

Belladonna was obtained as stated, and I think it would be only right that this plant should be known botanically as Amaryllis Parkeri.

This experiment would have verified van Tubergen's cross, but does not provide definitive evidence on the origin of the Kew Belladonna, reportedly the reciprocal cross. Descriptions of the flowers do not appear to have been published.

Worsley (1925) saw no reason to doubt the origin of these hybrids:

Both Herbert and Messrs. Van Tubergen used Brunsvigia Josephinae as the seed bearer, and the progeny raised by Messrs. Van Tubergen resemble Brunsvigia more than Amaryllis, and are quite distinct from the progeny which we possess of the reverse cross raised by Bidwell [sic] and Lady Parker, which latter resemble a giant form of Amaryllis, and were classed as such for many years.

While Hannibal (1994) saw no problem with the origin of *xBrunsdonna tubergenii* he has argued strongly against the involvement of *Brunsvigia* in the Kew Belladonna and related hybrids, called by him *Amaryllis x parkeri* and *Amaryllis x multiflora*, hypothesising that the 'Brunsvigia' parent was more likely to be *Cybistetes longifolia*. He argued that *Amarygia x parkeri* was not a first generation seedling, thus masking the *Cybistetes* features in the Kew Belladonna and related hybrids, but that such features were clearly seen in the 1866 etching of Sheather's plant. Fortunately Hannibal was sent photographs of two hybrids found in a long-abandoned garden in South Australia:

The blood red and bronze form was an obvious duplicate of the 1866 etching with typical pigmentation found in the cape *Cybistetes longifolia*. In turn the 50-flowered *alba* form was a typical *alba* throwback to *Cybistetes* quite like the old *A. baptisii alba* or H. B. Bradley's *A. 'Hathor'*, which was introduced in 1911 at a Sydney horticultural meeting.

Hannibal appears to base his entire argument on the two photographs

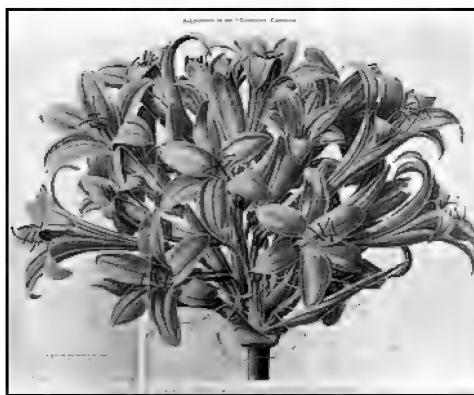


Fig. 11. *xBrunsdonna tubergenii*. van Tubergen jr, C. G. Brunsvigia josephinae x Amaryllis belladonna with plate. The Gardeners Chronicle 23rd January, p.57. 1909. This plant appears to be very similar to 'Ameliae', Fig. 12. Although possibly published in a colour version I have been unable to find one.

that he received from South Australia. His inference that Bidwill misidentified *Cybistetes* as *Brunsvigia* is not borne out by Bidwill's notes, which demonstrate that he was quite familiar with *Cybistetes longifolia*, called by him *Ammocharis falcata*, and had it in cultivation. Indeed the broader evidence of Bidwill's writings, both his Notebook and his numerous letters, published and unpublished, demonstrate that he was a competent and knowledgeable botanist very unlikely to make such an error.

A. belladonna by A. josephiniana. This cross is easily affected – a much larger quantity of seeds are borne by A belladonna when impregnated by A. Josephiniana or Brunsvigia multiflora than are ever produced in a naturally impregnated seed vessel – the seedlings are not very distinguishable from the pure ones of the same plants; there are however many different looking plants among the seedlings so that we may expect considerable variety in the flowers – some are at least 5 times as large as others – some have broad, some narrow leaves – Oct 20/42. At this time their second hibernation is commencing the bulbs vary from 1 by $\frac{3}{4}$ to 3 by 1 inch [2.5cm x 1.9cm to 7.6 x 2.5cm] in size. March 1847. Flowered at Camden – see Amaryllis Ameliae p7.² (Bidwill, Notebook p.4).

Page 7 of the notebook provides a detailed description of one of the *A. belladonna* x *B. josephinae* hybrids, named by Bidwill 'Ameliae'.

Amaryllis Ameliae or Josephini-belladonna (see p. 4) flowered in March 1847.

Named in complement to Mrs James Macarthur.

Scape 18 inches [46cm] high, section elliptic, spathe purplish green, rather persistent, peduncles $3\frac{3}{4}$ inch [9.5cm]; germen triangular, angles rounded – corolla 4 inches [10.2cm] – segments $\frac{3}{4}$ inch [1.9cm] wide, 2 upper sepaline segments reflexed as in Josephiniana – colour purplish rose variegated with white, but turning dark after expansion – stamens $1\frac{1}{2}$ inch [3.8cm] shorter than segments of corolla, white at base – coloured at tips – Anthers purple before bursting – Pollen hardly [indecipherable] – Flowers disposed in a somewhat circular manner, but a little inclined to one side.

Leaves [sentence not completed]

2 plants flowered as above a 3^d with 19 flowers on a shorter scape – the flowers shorter and wider & an almost spherical germen.

Leaves of this plant [sentence not completed].³ (Bidwill, nNotebook p.7).

His description of *Amaryllis* 'Ameliae' is clearly a plant possessing characters of both given parents. The reflexed upper sepaline segments Bidwill found particularly reminiscent of *B. josephinae*.

'A beautiful Amaryllis, called Amelia, from *A. belladonna* and *A. Josephinae*' was exhibited at the Autumn show of the Australasian Botanical and Horticultural Society in 1849 by Messrs J. and W. McArthur, winning the prize for the best hybrid.³ (Anon. 1849). This brief notice is probably the first public mention of this cross in Australia. *Amaryllis* 'Ameliae' was first listed in the Camden Park catalogues in 1850. A plant very similar to 'Ameliae' is still grown in Australia under a number of names including *xAmarygia parkeri*, and, in South Australia at least, incorrectly as *Brunsvigia josephinae* (Fig. 12). The flower of one of these plants, examined in the autumn of 2004, is quite typical. Inflorescence 85cm tall, green, slightly reddish at the base, bearing an umbel of 26 flowers, narrowly-funnel-shaped, up to 11cm long and 6cm across when fully expanded, very distinctly curved to present as a boat-shape. The upper perianth segments strongly reflexed when fully expanded, the lower hardly at all, the colour a very deep rose with purplish tones, paler orange-yellow at the base of the segments, the anthers distinctly purple before ripening. Individual flowers held almost horizontally on pedicels somewhat longer than the corolla, green, but distinctly red-tinged, very strongly and pleasantly fragrant. With the majority of flowers open the inflorescence resembles a flat-bottomed sphere in shape. The leaves are oblong in shape with a rounded end, similar to a broad-leaved *Amaryllis belladonna* but wider, the longest measuring 51cm and 6cm across at the broadest point near the centre. Unfortunately Bidwill left no description of the leaves of his plant. This plant flowered again in 2005 with 34 flowers in the umbel and I have since examined many flowers from several different sources but all conforming closely to this description. It does possess pollen. The grains are certainly smaller than those of *A. belladonna*, somewhat variable in size and tending to be flattened. In back-cross experiments one seed was obtained in 2005, similar in appearance to an *A. belladonna* seed, but only 3-4mm in diameter. This seed did produce a radicle but then disappeared. I have obtained several seeds since from

selfed flowers, all very small and none producing a viable seedling.

The appearance of this plant overall is intermediate between *Amaryllis belladonna* and *Brunsvigia sp.* as indeed is the description given by Bidwill of his hybrid 'Ameliae'. It is also somewhat similar to *xBrunsvigia tubergenii*, reportedly the reciprocal cross, *Brunsvigia josephinae x Amaryllis belladonna*. Of this cross Bidwill (1850) wrote 'I could never keep the seedlings alive which I raised from Josephinae, by Belladonna, and the one is produced very sparingly.' He commented further in his notebook:

A. Josephiniana by A. belladonna. A. Josephiniana does not bear much seed in Sydney but seed is produced just as readily by pollen of A. belladonna as by its own. The plants produced at the same time as those mentioned [of A. b by A. J. written above] are (Oct 20/42) not a quarter the size of those in the same soil and alongside one another – Oct 25. could not find one of these bulbs.³ (Bidwill, Notebook p.5).

This has also been my experience but I currently have two healthy three year old plants out of about fifty seeds sown.

Worsley (1925) hypothesised that the more robust constitution of *Amaryllis* when the female parent was a significant factor:

We find that all the bulbs of Brunsdonna parkeri [in Worsley's terminology *Brunsvigia x Amaryllis* hybrids] raised on *Brunsvigia* are difficult to grow. Herbert's bulbs [*B. josephinae x A. blanda*] apparently never flowered; Messrs. Van Tubergen's cross, although one grower in England has succeeded with it, has presented great difficulties to me; and Bidwell [sic] (who raised the hybrid both ways) remarks that he could never keep alive the hybrids raised on *B. Josephinae*, although those raised on *B. multiflora* did rather better. And this was in the favourable climate of Sidney [sic], N.S.W. On the contrary, the Bidwellian and Parkerian hybrids raised on *Amaryllis* flourish wherever they go, and I have never lost a single bulb, or seedling, or seen one in bad health.

As noted previously Hannibal (1994) queried the identity of Bidwill's *Brunsvigia multiflora*:

For years I have attempted to find the *Brunsvigia* species which Bidwill had used. All known *Brunsvigia* crosses have been repeated; they are very difficult to grow and are quite sterile. Finally it dawned on me that Bidwill had possibly used a *Cybistetes longifolia* (syn *Ammocharis heterostyla* and known by Linnaeus as *Crinum longifolia*) and not

'*Brunsvigia multiflora*' or even *B. josephinae*, as long assumed.

There is confusion in Hannibal's synonymy of *Cybistetes longifolia*, *Crinum longifolium* L. and *Ammocharis heterostyla*, as these taxa are not recognised synonyms. But Hannibal casts doubt on Bidwill's competence as a botanist which requires to be addressed.

Bidwill himself wrote of *B. multiflora*:

Brunsvigia multiflora – The same obs. as to Am. Jos. from which plant it hardly differs except in leaf – seedlings grow very slowly. I have seen a [undeciphered word] seedling of *B. multiflora* which at the age of three years had leaves 5 inches long and would probably flower in two years more – this was at Camden in rich stiff soil.³ (Bidwill, Notebook p.5).

This leaves little doubt that his *B. multiflora* is the *Brunsvigia* species today known as *Brunsvigia orientalis* (L.) Ait. ex Ecklon.

Bidwill's *A. belladonna* x *B. multiflora* hybrids were reportedly not dissimilar to the *B. josephinae* cross.

A. belladonna by Brunsvigia multiflora. These plants do not appear in general very different from the last [*A. belladonna* by *B. josephinae*] – there are however some plants among them which have broad leaves like the male parent and one in particular which is exceedingly curious from being covered all over with long stiff hairs – this could not be derived from any of the hairy Brunsvigias known there are none in the country and shows that the hairy leaves of some of the specimens in herbariums may have been derived from accidental plants and may not be species – Some of the hairs are proportionally quite as long as on the specimens of *Buphane guttata* pl.22. [of Herbert's Amaryllidaceae].³ (Bidwill, Notebook p.4).

Bidwill (1850) expanded elsewhere on the difference between his *Amaryllis belladonna* x *Brunsvigia* hybrids, including differences in the flowers:

I raised in Feb. 1841, a vast number of seedlings from Belladonna, by Josephinae, and by Brunsvigia multiflora. Belladonna bears many more seeds when impregnated by either of these plants than when naturally impregnated, but the seeds are much smaller. These seedlings flowered for the first time in March 1847, and are extremely beautiful.

Their colour is generally like that of *Passiflora Kermesina*⁷, [i.e.

⁷ Bidwill was very familiar with *Passiflora kermesina*, having used it as a parent in many hybrids, some of them, such as *P. 'Floribunda'* named and widely distributed throughout Australia by William Macarthur and even sent to England.

purplish-rose], but it varies in different specimens, and many are blotched with white – from 20 to 40 on a scape. The shape varies greatly, the crosses by *B. multiflora* being generally wider in the segments than the others, and of a better figure, shorter and more ringent.

Although Bidwill described some variation both within his *josephinae* and *multiflora* crosses and between them, his descriptions of his *Amaryllis* x *Brunsvigia* hybrids bear a much stronger resemblance to *xBrunsdonna tubergenii* than to the *xAmarygia parkeri* hybrids. The possibility is that the latter plants are, as suggested by Hannibal (1994) second or later generation crosses. Bidwill (1850) believed his hybrids to be sterile: ‘The germen does not seem to seem to contain any ovules, and the anthers are without pollen’, a finding confirmed by Hannibal (1994). If they are correct and sterility is absolute in the first generation it is impossible for the *Amaryllis* x *multiflora* hybrids to be derived from them. If some fertile pollen is produced then a backcross to *Amaryllis belladonna* is a possible origin. The notice in The Gardeners Chronicle (Anon. 1875) merely describes Lady Parker’s seedling as ‘a cross between Amaryllis Belladonna and Brunsvigia Josephinae’, leaving a backcross as a possibility.

Hannibal (1980) claims that such a backcross was carried out, but that the male parent was *Brunsvigia orientalis*:

In Bidwell’s [sic] day *B. orientalis* L. was better known as *B. multiflora* Aiton, and later as *B. gigantea* Heister. True, Bidwell did use *B. josephinae* too, but his hardest and most successful cross was *A. belladonna* x *B. orientalis* L., and when the more prolific backcrosses with *A. belladonna* appeared at the John Macarthur estate at Camden Park, NSW, the backcross hybrid was accepted in Australia as *A. x ‘multiflora’* and ‘*Baptisti alba*’ etc. His crosses with *B. josephinae* were relatively tender, and has been found with repeated crosses, such soon fail when grown under ordinary gardening practices. Summer rains at Sydney or summer watering rots these bulbs.

Significantly *A. x parkeri* is simply a sibling backcross of *Brunsdonna bidwellii* onto *A. belladonna* effected by Lady Parker under Bidwell’s instructions. Lady Parker was the daughter of the above John Macarthur of Camden Park which I have visited. Sir Henry Parker and W. Watson were in error stating *B. josephinae* was the parent used in the cross.

Hannibal does not state the source of this information and there is no literature to support his assertions, which, although written as definitive statements, must be considered as purely speculative. Doutt (1994) repeats the claim that such a backcross was made, basing his information on Hannibal's paper:

A sibling backcross of *Brunsdonna bidwellii* onto *Amaryllis belladonna* was done by Lady Parker under Bidwell's [sic] instruction, and this is listed in Hortus Third as *Amarygia parkeri*.

In Holland in 1935 T. M. Hoog, of Van Tubergen's nursery, Haarlem, reported successfully carrying out a very similar backcross:

For many years we have tried to improve *Amaryllis belladonna* and what we have obtained is shown by the enclosed photograph. *Amaryllis belladonna* was crossed with *Brunsvigia josephinae* and *B. gigantea* and this produced *Amaryllis belladonna parkeri*, which is a tall "Belladonna" with a large number (up to 20) of flowers. Alas, owing to *Brunsvigia*, it will only grow and flower well in a climate which has a very hot summer and autumn, like the south of France, Italy or Spain. As we have in Holland a variety of *A. belladonna* (*var. purpurea major*) (Fig. 13) which even in our cold climate always blooms regularly and, if well established, with several spikes, we obtained seeds from this by hybridisation with the said *A. belladonna parkeri* and this resulted in a strain of free blooming "Belladonas" with numerous and large flowers of a very beautiful colouring, deep pink and white with yellowish throat, on strong stems.

There are as you know in September and October very few or no bulbous plants in flower with long stems and large beautifully coloured blooms, which are of long endurance. Here is one of great beauty.

This hybrid was named *Amaryllis belladonna parkeri* var. *zwanenburg*.

Hoog's report poses two important questions. Firstly, it is unclear which of the first crosses, *A. belladonna* x *B. josephinae* or



Fig. 13. *Amaryllis belladonna* L. var. *rubra*. Flore des Serres f.1415. 1859. This Dutch variety is probably very similar to *purpurea major* used by T. M. Hoog, of Van Tubergen's nursery 80 years later. Figure courtesy of the Biodiversity Heritage Library.

A. belladonna x *B. gigantea* [*B. orientalis*] was used for the backcross. If both were used were there differences in the progeny? Secondly, does the choice of the name *Amaryllis belladonna parkeri* indicate that the progeny looked like *xAmarygia parkeri*, or was it chosen for another reason, perhaps because Hoog and his colleagues believed that they were reproducing the cross that produced *xAmarygia parkeri*? I had hoped that records of these crosses might still exist in Van Tubergen's archives, but extensive enquiries, including contact with Hoog's grandson, failed to reveal any.

Whatever the answer to these questions the backcrossed plants appear to be typical multiflora *Amaryllis* hybrids. The description could be of Silas Sheather's 'Amaryllis hybrid' of 1866, Miss Fletcher's flower or of 'The Kew Belladonna Lily' of 1898. The two plants illustrated in Hoog's paper show distinct differences, one appears to have smaller flowers with narrower, more pointed segments, but these differences are no greater than those seen between clones in a very large population of multiflora *Amaryllis*, at Camden Park for example.

At Camden Park today there are many hundreds of *Amaryllis* of unknown origin, although they appear to have been there for many years, some forming clumps a metre or more across. Most show clear signs of hybridity, many of them typical *xAmarygia parkeri* hybrids, with twenty or more flowers per umbel, in shades varying from pure white to almost crimson, some with very pale pink segments with darker tips, all with yellow throats, many verging on orange (Fig. 14). It is obvious that much self-seeding has occurred over the years, producing plants that are indistinguishable from *A. belladonna*, others with more vibrant colouring, in every shade of red and pink, differing only from a more typical *xAmarygia parkeri* in that they bear fewer flowers per scape. Particularly striking are the drifts of *Amaryllis* that are naturalised under trees at the base of the slope known as Blarney. These too vary from typical *xAmarygia parkeri* to plants closely resembling *A. belladonna*.

SUMMARY AND CONCLUSION

To John Bidwill must go the distinction of being the first person to produce a flowering plant of an *Amaryllis belladonna* x *Brunsvigia* sp. hybrid. He achieved this distinction with two species of *Brunsvigia*, one of which was certainly *B. josephinae* and the other *B. orientalis*, called by Bidwill *B. multiflora*. His notebook provides very valuable information



Fig.12. *xAmarygia parkeri* (W.Watson) H.E.Moore 'Ameliae'. Photographed in the authors's garden. This plant conforms very closely to Bidwill's description of 'Ameliae'. Photograph by Colin Mills.



Fig.14. *xAmarygia parkeri* (W.Watson) H.E.Moore. Typical deep pink form at Camden Park. Photograph by Colin Mills.

on the history of *Amaryllis* x *Brunsvigia* hybrids but the exact origins of *xAmarygia parkeri* remains an open question.

Some of Bidwill's offspring were outstandingly beautiful, one being named *Amaryllis* 'Ameliae' in honour of Emily Macarthur, the wife of his patron and close friend, James Macarthur, brother of William. It is likely that 'Ameliae' or her siblings were widely distributed within Australia, to other members of the Macarthur family, such as Emmeline Parker, and probably to ex-employees such as Silas Sheather or to customers of William's extensive wholesale and retail nursery business, such as the Sydney nurseryman John Baptiste.

'Ameliae' is quite distinct from the large-flowered *Amaryllis* hybrids known under a variety of names today but which should all be encompassed under the name *xAmarygia parkeri* (W.Watson) H.E.Moore.

Lady Emmeline Parker, through her gardener Mr. Boivell, claimed that the plant that she exhibited in London in 1875, later to be called the Kew Belladonna and now correctly called *xAmarygia parkeri*, was the progeny of *Amaryllis belladonna* crossed with *Brunsvigia josephinae*. There is no evidence that would cause us to doubt this statement, although attempts to reproduce these beautiful plants as F1 hybrids have not been successful. This suggests that other mechanisms are involved. Back-crossing to *A. belladonna* has been proposed as such a mechanism and such crosses were carried out by T. M. Hoog at Van Tubergen's nursery, Haarlem in 1835. Unfortunately the identity of the plants used is not clear. Most of the *Brunsvigia* character was apparently lost in Hoog's plants, the back-cross progeny looking like typical *xAmarygia parkeri* hybrids.

Hannibal (1980) stated emphatically that Emmeline Parker had earlier backcrossed an *A. belladonna* x *B. josephinae* hybrid to *A. belladonna* to produce the plant eventually given the name *xAmarygia parkeri* in her honour but gave no reference for his information and no supporting evidence. Hannibal (1994) later radically changed his opinion.

It is unlikely that Bidwill ever saw this beautiful plant in flower. He left for Wide Bay in 1848 and died there in 1853. Interestingly Bidwill wrote to Philip Parker King in 1848 or 1849:

See if you can get from [indecipherable probably Government] garden a root belonging to one amaryllis [difficult to read but probably Ameliae] do not let it be named anything else. I called it after Mrs. James Macarthur. I raised it in 1841 from seed of Belladonna impregnated by Josephiniana.

There is one root in a pot labelled and with my name on the label in full length. Mr. [indecipherable but probably Moore] ought to know it.³ (King Papers).

Perhaps Bidwill intended carrying out further hybridisation experiments with it.

The question of origin will not be fully answered until the relevant crosses are repeated under controlled conditions that leave no margin of doubt.

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A RARE NEW SUBSPECIES AND CHANGE OF RANK IN *ALSTROEMERIA* L. (ALSTROEMERIACEAE) FOR TAXA NARROWLY ENDEMIC TO CHILE'S ATACAMA REGION

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ABSTRACT

Alstroemeria philippii subsp. *adrianae* is an attractive novelty from the biodiverse Chilean coastal fringe just inland of Sarco, Huasco Province in the Region of Atacama. It forms part of an extensive, major group of about six or seven base species, including *A. philippii* subsp. *philippii*, *A. magnifica* and *A. violacea*, its geographically closest relatives. At present it is only known from the type site. The decision to designate it as subspecies is discussed. *Alstroemeria werdermannii* var. *flavicans* is formally raised here to subspecific rank.

KEYWORDS: *Alstroemeria*, biodiversity, Chile, conservation status, fog desert, rank.

INTRODUCTION

Alstroemeria philippii Baker subsp. *adrianae* J.M. Watson & A.R. Flores (Fig. 1-2), a medium-sized geophyte, inhabits the fertile Pacific coastline of Chile at the far southern edge of the Atacama desert, where it forms part of a prolific and diverse but erratic spring flora.

In early November 2004 the botanical naturalist Adriana Hoffmann and one of the present writers, John Watson, made a brief field survey in the south of the so-called Chilean Flowering Desert to gather additional material towards a forthcoming field guide selection in Spanish (in preparation) for the Fundación Claudio Gay series. Coastal and lowland terrains of the Atacama (III) and Coquimbo (IV) Regions were explored. We aimed as far as possible to traverse this particular sector by tracks which had rarely if at all been used for serious, comprehensive botanical investigation.

Conditions during spring 2004 were strongly localised. North of Copiapó a near-sterile season was reported. To the south, restricted fronts of rain, sporadic but violent showery storms, and regular sea-generated

fogs (*camanchacas*) had created a patchwork effect of heavy blooming alternating with near-total drought. Particularly intense and spectacular floral development was reported for the stretch between Totoral Bajo and Carrizalillo (27°48'S to 29°10'S). This both influenced our choice of route and induced the significant performance of the new taxon that led to its discovery.

***Alstroemeria philippii* Baker subsp. *adrianae* J.M. Watson & A.R. Flores,
subsp. nov.**

*A subspecies typica notis absentis et maculis fere absentis in tertio apicali
tepalorum interiorium superiorum et perigonii semper albis, necnon
distributio horizontala separata.*

Type: CHILE, Atacama (III Region), Huasco Province, about 20 km inland SE of Caleta Sarco (28°55'S - 71°23'W). Ca 100 m. 06 November 2004.

J.W. 10930. Collectors: J.M. Watson & A.E. Hoffmann. (Holotype: SGO.
Isotypes: pending for CONC, K.) (Fig. 1-3)

Perennial glabrous herb. *Root system* not investigated, but presumably rhizomatous, with terminal starchy, fusiform storage tubers. *Stems* simple (unbranched), erect to ascending sterile and fertile developments occur simultaneously. *Sterile shoots* ca 30-40 cm, foliose, densely so towards apex, usually with 2-3 remote, papery, triangular, sessile, acute basal scale *leaves* 2.5-5 mm long, and 1 lowermost linear-triangular, sessile, acute *leaf* 12-15 mm long; *developed leaves* 35-70 x 4-10 mm, alternate, resupinate, twisted through 180° basally, then more or less further spiralled throughout length, lanceolate, entire, acute, cuneate (tapering) to a short, inconspicuous *pseudopetiole*, bright green, very shiny on functional upper surface, lined with fine parallel veins beneath, margins entire, with minute, irregular, vitreous, translucent gibbous processes. *Fertile shoots* with inflorescence ca 30-42 cm, foliate below inflorescence. *Leaves* sessile, triangular-lanceolate, from 5 mm long at stem base, becoming longer above to 18 mm, rather thin. *Involucral bracts* 3-4, as uppermost leaves. *Inflorescence* a compound, rarely simple, umbel of 1-2 basic cymose radii 5-11.5 cm long, 1-2(-3)-branched or unbranched, lateral branches 2-5.5 cm, with a small, basal leaf-like bract. *Flowers* solitary on each termination. *Perigone* flaring widely from the throat, basic colour white with very faint pinkish violet



Fig. 2. *Alstroemeria philippii* subsp. *adrianae* at the type site, Caleta Sarco district, Atacama Region, 2004.

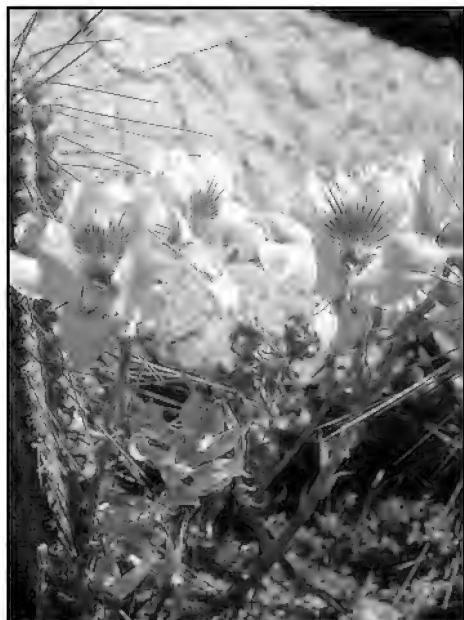


Fig. 1. *Alstroemeria philippii* subsp. *adrianae*. Protected by cactus spines, a typical habitat. Caleta Sarco district, Atacama Region, 2004.



Fig. 3. *Alstroemeria philippii* subsp. *adrianae*, the notably glossy foliage. Caleta Sarco district, Atacama Region, 2004.

overall cast. *Tepals* with outer and inner-upper sets strongly tapered to stalk-like base (claw), all tepals minutely serrate in apical half, tipped with pale or dark small mucro. Outer 3 tepals 3.7-5 x 2-2.6 cm, broadly obovate, bluntly rounded, emarginate. Inner tepals obtuse to subobtuse. Inner-lower tepal 3.6-4.2 x 1.4-2 cm, elliptic to narrowly obovate, median third a dark yellow, rather irregular zone, and marked with longitudinal, maroon-red broken streaking and dashes, these joined and forming an integrated stain below yellow zone and becoming more diffuse and infrequent apically, scarce above yellow zone and absent at tip. *Stamens* (6). *Anthers* pseudo-basifix, purple-brown. *Style* and *stigma* pale pinkish violet, shorter than tepals. *Stigma* trifid. *Capsule* 6-ribbed. *Seeds* unknown.

HABITAT, FLORAL COMMUNITY AND ECOLOGY

The new subspecies was discovered somewhat inland on the elevated levels (*llanos*) along a 26 km stretch turning away from the coast near Caleta Sarco and finally connecting with the Domeyko to Carrizalillo route. The alstroemeria was observed as one large and sprawling but integrated population which began and ended fairly abruptly. However it appeared to be numerically quite plentiful overall. These field observations suggest a very local range, apparently confined to a limited area of a few square kilometers.

A rich and typical variety of surrounding local vegetation was in exuberant seasonal flower. Prominently evident and noted were *Balbisia peduncularis* (Lindl.) D. Don, *Calliandra chilensis* Benth., a densely cushion-forming *Chorizanthe* sp., *Copiapoa coquimbana* (Karw. ex Rümpler) Britton & Rose, *Echinopsis deserticola* (Werderm.) Friedrich & Rowley, *Encelia canescens* Lam., *Mesembryanthemum crystallinum* L., *Oenothera coquimbensis* Gay, also *Cristaria* and *Eriosyce* spp. With the exception of a few ephemeral, insignificant individuals, Poaceae (Graminae) was unrepresented, as is usual in such formations. When not in active growth and flower, this phytocommunity retires into deep dormancy and presents a sere, colourless, moribund-looking landscape of open low to dwarfish twiggy and cushion shrubbery with cacti. *A. philippii* subsp. *adrianae* grew in the protection of patches of scrub and, in particular, around and among large cacti.

The hitherto relatively unexplored terrain between Huasco and Punta

Fig. 4. *Alstroemeria werdermannii* subsp. *flavicans*. Punta Choros, Coquimbo Region, 2004.

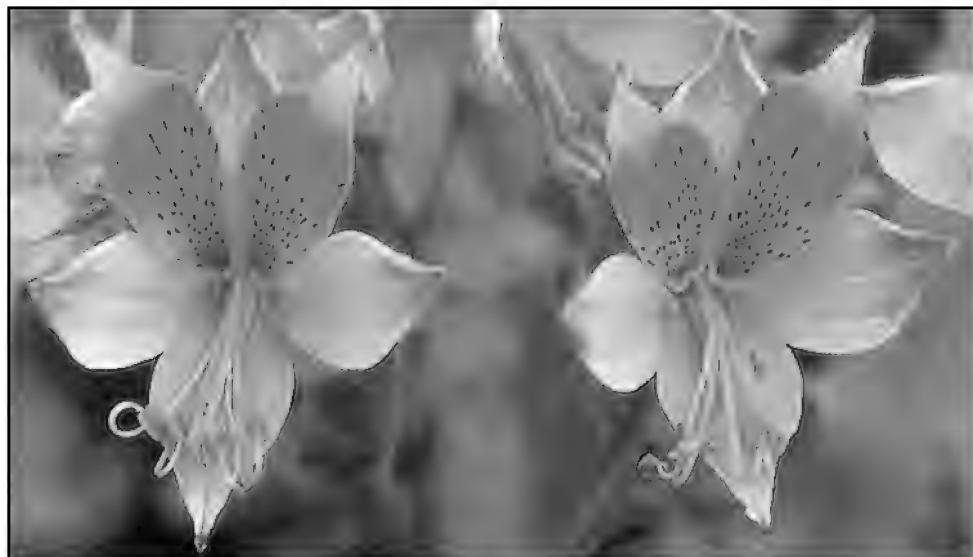


Fig. 5. *Alstroemeria werdermannii* subsp. *flavicans*. A form lacking all dark markings except speckling. Punta Choros, Coquimbo Region, 2004.



Fig. 6. *Alstroemeria werdermannii* subsp. *flavicans*. Note chocolate zoning and blotching on all inner tepals. Punta Choros, Coquimbo Region, 2004.



Fig. 7. *Alstroemeria werdermannii* subsp. *flavicans*. Coastal sand dune habitat. Punta Choros, Coquimbo Region, 2004.

Choros has proved particularly productive of new *Alstroemeria* taxa recently. As well as the novelty described here, it has yielded *Alstroemeria werdermannii* Ehr. Bayer subsp. *flavicans* (M. Muñoz) J.M. Watson & A.R. Flores (Fig. 4-7) (Muñoz 2000) and *Alstroemeria philippii* Baker var. *albicans* M. Muñoz (Fig. 8) (2003). Another small species within the *Alstroemeria kingii* Phil. and *Alstroemeria diluta* Ehr. Bayer alliance was noted nearby (pers. obs.). The vegetation type is classified within Chile as *Desierto Costero del Huasco* (Coastal desert formation of the local region of the lower Huasco River) (Gajardo 1994).

DEDICATION

We are pleased to name such an attractive and showy alstroemeria for our good friend and work colleague, Adriana Hoffmann, who was active in its discovery. She has done so much both privately and officially to encourage popular Chilean interest in the natural heritage, and continues to do so. This includes promoting awareness and concern for the marvellous diversity of the flora, for ecosystems, especially native woodlands, and for a healthy, sustainable environment. *Alstroemeria* rates high among her favourite genera.

TAXONOMY AND IMMEDIATE RELATIONSHIP

The showy alliance to which the new plant belongs has been formally defined and published as *Alstroemeria* series *Magnifica* Ravenna (2000). Our investigations suggest the foundation of his classification is invalid, and should be modified or replaced. This view is supported by Aagesen & Sanso (2003): "The infrageneric divisions proposed by Ravenna (2000) do not agree with the provisions of the ICBN ..." Whatever the outcome of its nomenclature, the distributional extremes of the infrageneric group's taxa are represented by *Alstroemeria violacea* Phil. (Fig. 9-10) at Arequipa, coastal Peru, and a subspecies of *Alstroemeria pulchra* Sims in the Cordillera de Nahuelbuta, a range of hills fronting and including the littoral of southerly Chile (Bayer 1987). The new subspecies appears to have a well interconnected although quite limited, discrete and unique distribution within the complex.

Deciding what rank to assign the discovery posed slight problems and is inevitably to a degree both subjective and influenced by customary practice in the genus. At a casual glance it looks similar to other allies with

variants that share its off-white flowers, including prominent populations of typical *A. magnifica* Herb. (Fig. 11-12) shortly south of Coquimbo. It also approaches forms of *A. violacea* (Fig 9-10) in the somewhat wider, squarer, more open disposition of its flower and less marked flecking on the apex of the inner tepals. Of the *A. magnifica* species complex, var. *tofoensis* M. Muñoz exhibits the same reduced tepal flecking. Otherwise however, most of these differ markedly in other aspects, most of them particularly in their tall, robust, multi-flowered growth forms and more prominent foliage. These distinctly vigorous taxa include recently described *A. philippii* var. *albicans* (Fig. 8). Equivalent slighter but more distant relatives include *Alstroemeria magnifica* ssp. *magenta* (Ehr. Bayer) M. Muñoz (Fig. 13-14) and the sometimes white-flowered *A. pulchra* subsp. *pulchra* (Fig. 15).

Despite any such superficial similarities to related elements, on close examination the new discovery presented a subtle combination of several features that are quite unique. In addition, despite the difference in surface outgrowths on the leaf veins, *A. philippii* s.l. (Fig. 16-17) not only has the facies of being the closest relative, but also appears sufficiently proximate to be linked subspecifically. The essential bases for this decision were geographical vicinity and the ratio of the tepals, where the inner-upper pair are relatively longer compared with the topmost of the external three. This is a key character in the definition of *A. philippii* s.l. In our opinion the new taxon also aligns well with morphological and adjacent geographical criteria followed for *Alstroemeria hookeri* Lodd. subsp. *maculata* Ehr. Bayer (Bayer op. cit., Muñoz & Moreira 2003). The only reasonable alternative for *A. philippii* subsp. *adrianae* would appear to be as full species. Future cytological studies may perhaps determine the situation beyond doubt.

We feel we should make clear here that we do not subscribe to the system followed by some taxonomists, including for *Alstroemeria*, whereby subspecies are defined by rigid application of total geographical separation (i.e. they must be allopatric). Equivalent but sympatric infraspecific taxa classify as obligatory varieties. While agreeing that geographical separation is an important element in defining rank, we consider that other factors, such as degree and significance of morphological differences, should also form part of the evaluation. Stace (1996) remarks in the context of species, "... frequently it is left to the taxonomist to apply his judgement. Often he does this by attempting to recognize as species units that are of comparable

significance in whatever terms are being applied.” We consider the same flexible commonsense approach should apply wherever appropriate across the taxonomic board. Nature does not by any means evolve along rigid, formulaic lines, or even to a consistent pattern. Stace (op. cit.) comments at length elsewhere about infraspecific definitions. He speaks favourably of the influential definitions by Du Rietz (1930), whose subspecies is given as “... a more or less distinct regional facies of a species”. Stace interprets this in part as, “It is thus a geographical race ...” The point to note is that neither Du Rietz or Stace added or even implied ‘***in isolation***’, nor do the vast majority of pragmatic taxonomists follow such an isolation concept.

Applying these criteria, in our opinion a taxon mentioned above as an example, and which was published as a variety of *Alstroemeria werdermannii* Ehr. Bayer (Fig. 18-19), clearly bears the characteristics of subspecies. We accordingly make the following formal taxonomic change:

***Alstroemeria werdermannii* Ehr. Bayer subsp. *flavicans* (M. Muñoz) J.M Watson & A.R. Flores stat. nov.** (Fig. 4-7)

Basionym *A. werdermannii* var. *flavicans* M. Muñoz Schick, Gayana Bot. 57(1):57, 2000.

OBSERVATIONS AND DISCUSSION

Alstroemeria philippii* subsp. *adrianae

The scattered, elongated, uneven, glassy processes around leaf margins on the sterile shoots can only be observed well through a reasonably powerful hand lens (e.g. x 15) or a stronger visual aid. They follow the line of the margin closely and discontinuously, like water which has frozen hard.

They also occur on the margins of several other related taxa, and along the undersurface veins of typical *A. philippii*, where usually more pyramidal and prominent, as also sometimes on *A. magnifica* variants (Bayer op. cit., Muñoz & Moreira op. cit.). A technical description is provided in Aagesen & Sanso (op. cit.).

One of the small number of samples taken was intermediate between sterile and fertile shoots. It had the foliage characteristics of the former, but with a short, solitary, terminal pedicel of 1.2 cm subtended by a single bract. The flower was normal.

The tepals of many flowers had suffered considerable predation by insects. Some were almost entirely eaten away and it was not easy to find

specimens in acceptable condition for photography or scientific collection. Anthers were often missing in addition. Such sterile stamens appear to be a natural, innate condition of the population, perhaps relating in some way to genetically controlled uneven ripening of anthers (Aagesen & Sanso op. cit.), rather than the result of depredation.

The collective climate type experienced by *A. philippii* subsp. *adrianae* and its immediately related taxa is sea-board and interior low mediterranean or, at higher latitudes, fog-oases in the otherwise sterile maritime desert: but it also includes combinations and transitions of these.

Floration of the corresponding bioregions is extremely erratic over time and space, being dependent on the global El Niño event (Couper-Johnston 2000) or very local favourable weather conditions, above all sufficient moisture. The presence or absence, strength, overall taxonomic balance, distribution and timing of blooming is notably unpredictable and variable from year to year. This tendency increases further inland or towards and into the tropics, where a decade or more almost without significant flowering is not uncommon (pers. obs.).

Alstroemeria philippii subsp. *adrianae* is without doubt highly vulnerable *in situ*. It represents one small but significant link in a complex chain of magnificent yet extremely fragile kaleidoscopic ecosystems and discrete desert oases covering some thousand and a half kilometers of the northern Chilean Pacific coast. These are universally recognized as a world biodiversity 'hot spot' and natural heritage. It is a matter of extreme regret that supportive legislation for them is close to non-existent over their full range, either at regional or national level. Effective physical protection is no more than a vain dream. As examples of the assorted threats they face, numbers of colossal coal-burning generators are being built or planned along their shores with government sanction; international motocross and four-wheel drive rallies pass through them and stimulate regular, year-round off-track activity, in particular over dunes; and with increasing prosperity, holiday shack shanties and bungalow parks are mushrooming around centres of population with little or no planning control.

ACKNOWLEDGEMENTS

We are indebted to Dr Alan Meerow and Dr Ehrentraud Bayer for their valuable comments and suggestions. These not only greatly improved and strengthened the text, but have implicitly given much appreciated broad

approval to the contents.

All photographs by J.M. Watson.

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Fig. 8. *Alstroemeria philippii* var. *albicans*. Another local rarity, but it differs considerably from subsp. *adrianae*. Aguada Tongoy, Atacama Region, 2004.



Fig. 9. *Alstroemeria violacea*. Cerro Perales, Antofagasta Region, 2002.



Fig. 10. *Alstroemeria violacea*. The perianth outline is near to that of *A. philippii* subsp. *adrianae*. Taltal, Antofagasta Region, 2003.



Fig. 11. *Alstroemeria magnifica* subsp. *magnifica*, white form, is notably more vigorous than *A. philippii* subsp. *adrianae*. South of Coquimbo, 2008.



Fig. 12. *Alstroemeria magnifica* subsp. *magnifica*, white form, although similar in colour, differs strongly otherwise from the new taxon. South of Coquimbo, 2008.



Fig. 13. *Alstroemeria magnifica* subsp. *magenta* does not closely resemble *A. philippii* subsp. *adrianae* in flower. Talinay, Coquimbo Region, 1991.



Fig. 14. *Alstroemeria magnifica* subsp. *magenta* shares the slender growth of *A. philippii* subsp. *adrianae*. Mantos de Hornillo, Coquimbo Region, 2008.



Fig. 15. *Alstroemeria pulchra* subsp. *pulchra* clearly has floral traits in common with others of the complex. Concon, Valparaíso Region, 1972.



Fig. 16. *Alstroemeria philippii* subsp. *philippii*. The type subspecies with its duller leaves. Huasco, Atacama Region, 1991.



Fig. 17. *Alstroemeria philippii* subsp. *philippii*. Quite distinct in colour and markings from its new subspecies. Huasco, Atacama Region, 2004.

Fig. 18. *Alstroemeria werdermannii* subsp. *werdermannii* contrasting notably with its yellow subspecies. Huasco, Atacama Region, 1997.

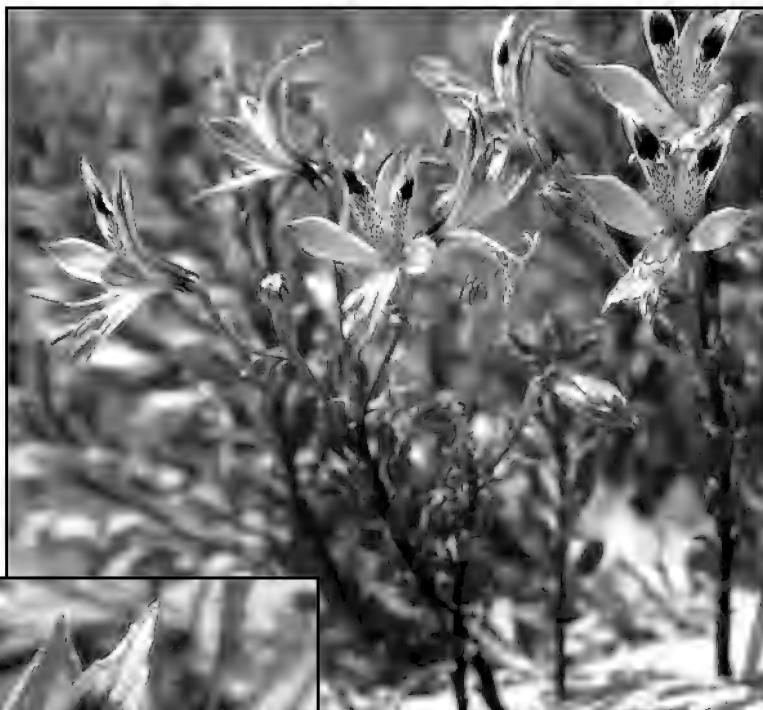


Fig. 19. *Alstroemeria werdermannii* subsp. *werdermannii*. A close-up to compare with the yellow subspecies *flavicans*. Huasco, Atacama Region, 1997.

A NEW SUBSPECIES OF *TULBAGHIA VIOLACEA* HARV. FROM KABOEGA (ZUURBERG, SOMERSET EAST, SOUTH AFRICA)

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ABSTRACT

A new subspecies of *Tulbaghia violacea* Harv. subsp. *macmasteri* Vosa is described and illustrated. The new taxon differs from the typical species in the morphology of its flowers as well as in its mountain habitat which is very dry and rocky.

Key words: new subspecies, *Tulbaghia violacea*, Harv., Alliaceae.

INTRODUCTION

The Kaboega Game Farm, where the plant under study is found, is located in the northern part of the Zuurberg Mountain Range (Somerset East District, Eastern Cape) in a particularly dry region which receives an average of only about 300 mm rain per year. The rainy season is mainly in the spring and autumn, peaking bimodally from October-November and February-March. The rain comes mainly in the form of short, heavy showers, with occasional drizzle associated with cold fronts. Such a climatic regime produces rather dry vegetation classified as Zuurberg Quartzite Fynbos (Mucina and Rutherford, 2006), and it is remarkable that a *Tulbaghia* of the *violacea* alliance would be found in such an area. In fact typical *Tulbaghia violacea*, throughout its distribution area, is usually found growing in more or less moist places such as stream banks and/or humid vleis.

A population of the plant in question was discovered by Cameron McMaster during one of his botanizing excursions in the Eastern Cape, on the south facing steep slope of a high mountain at about 530 m altitude, growing amongst Zuurberg Quartzite rocks (Fig. 1). The population,

around the site of discovery, consisted of widely scattered plants over an area of about 100 square meters.

Owing to its bright mauve coloured flowers, at first glance a flowering plant of the entity in question would appear as a 'normal' *T. violacea* were it not for the unusual habitat and for the peculiar morphology of its flowers and the narrow leaves, as duly noticed by a very keen naturalist such as Cameron McMaster.

The perianth segments of the flowers of the plant in question are rather narrow with more or less parallel edges and are channeled. Moreover, the tips of three inner perianth segments are cucullate and somewhat mucronate (Fig. 2 and 3). Thanks to the courtesy of Ian Ritchie, Manager of the Kaboega Game Farm, I had the chance of visiting the site on the 6th of October 2008, but at the time the plants were just beginning to grow with only about 2 cm of the leaves showing above ground. I was nevertheless able to collect a living specimen which has been used for the cytological analysis. Chromosome number and morphology are the same as those of *Tulbaghia violacea* (karyotype Group 2, Vosa, 1975, 2000)

Regarding the growing habit of the new taxon, it is very remarkable that during visits to the site of discovery in January and in February 2009, its usual flowering period, the plant in question did not show above ground and was impossible to locate even in some particular spots where it was observed before. It is possible that the very dry season experienced recently at the location may have delayed or very probably inhibited growing and flowering altogether.

Besides flower and leaf morphology, the special habitat and its consequences distinguishes the Kaboega plant from the typical *T. violacea* Harvey, and in our opinion the new entity fully deserves recognition at the subspecific level. I am very happy to name this subspecies after the discoverer J. C. McMaster.

Tulbaghia violacea Harv. subsp. *macmasteri* Vosa, subsp. *nova*

Chromosomatum numerus $2n=2x=12$

Karyotype of Group 2 (Vosa, 1975, 2000)

TYPUS: South Africa. Cape - S 33° 16.280, E 25° 26.115 (Somerset East district): Kaboega Game Farm, growing in association with *Encephalartos*



Fig. 1. The habitat of *Tulbaghia violacea* Harv. subsp. *macmasteri* Vosa. Note the typical dry Mountain Fynbos, characterized in this case by the presence of a large colony of *Encephalartus longifolius*. (Photograph taken on 6th October 2008 by the author.)

longifolius (Jacq.) Lehm. in Zuurberg Quartzite Fynbos among rocks, on a south-facing steep slope in full sun at about 530 m altitude, in flower 06/01/2008, J.C. McMaster 120, GRA (Fig. 4).

DIAGNOSIS:

Ab species typica statura minore et segmentis perianthium angusticanaliculatis, segmenta interiora apicis cucullata et leviter mucronata etiam habitat montanus aridus et saxosus differt.

DESCRIPTION:

Rootstock: a fleshy, somewhat elongated, pear-shaped corm 1.5 to about 2 cm long and 8 to 10 mm in diameter at its basis, covered with the brownish scarios leaf bases and placed on a poorly defined rhizome. Roots: numerous moderately fleshy. Leaves: 3 to 6, bright green, about 1.0 to 1.5 mm wide and about 20 cm long. Scape: green, 1 to 1.5 mm in diameter, longer than the recumbent leaves. Umbel: 5 to 7 flowered. Spathe valves: two, lanceolate, scarios at anthesis. Pedicels: green, rather thin, about 12 to 15 mm long.



Fig. 2. Inflorescence of *T. violacea* Harv. subsp. *macmasteri* Vosa. Note the starry flowers with narrow channel-shaped perianth segments and the cucullate and slightly mucronate tip of the inner segments. (Photograph by Dr. Petra Wester.)

Perianth tube: very narrowly funnel-shaped about 10 mm long. Perianth segments: about 6 mm long, purple-violet in colour, very narrow from 0.9 to 1 mm wide with inflexed edges, the inner segments with a somewhat cucullate, inward hooked tip. Corona: formed by three slightly fleshy, deltoid/elongated processes about 1.5 to 2 mm long, placed at the basis of the inner perianth segments. Anthers: in two whorls about 1 mm apart, the upper placed almost at the rim of the perianth tube, the lower just above the stigma, bright yellow at dehiscence. Ovary: about 2 mm long, ovoid, somewhat triangular in section with rounded corners. Style: 1 mm long; Stigma: slightly capitate. Seed capsule: mitre-shaped, about 5 mm long and 4 mm wide when ripe. Seeds: black, about 1.5 to 2 mm long.

Flower colour of the plants associated with the type specimen, as assessed by Dr. Petra Wester of Stellenbosch University, after the CMYK colour-space in Kueppers, H. 1999 (DuMont's Farbenatlas, DuMont, Koeln, Germany), is C40 M70 Y10.

ACKNOWLEDGEMENTS

I wish to thank Mr. Cameron McMaster of Napier, South Africa who discovered the new taxon and furnished me with a very good herbarium specimen, which has been used as the typus, as well as for the very nice photographs of the flowers and of the site of discovery. I am also very grateful to Mr. Ian Ritchie, Manager of the Kaboega Game Farm, for his help and kindness. My thanks are also due to Dr. Petra Wester of the Department of Botany and Zoology of the University of Stellenbosch, South Africa for useful advice and for a number of excellent photographic materials, and to Mr. Tony Dold, Curator of the Selmar Schonland Herbarium (GRA) for valid help and kindness during my visit at the Albany Museum, Grahamstown, South Africa.

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Fig. 3. Side view of the inflorescence of *T. violacea* Harv. subsp. *macmasteri* Vosa. (Photograph by Dr. Petra Wester.)

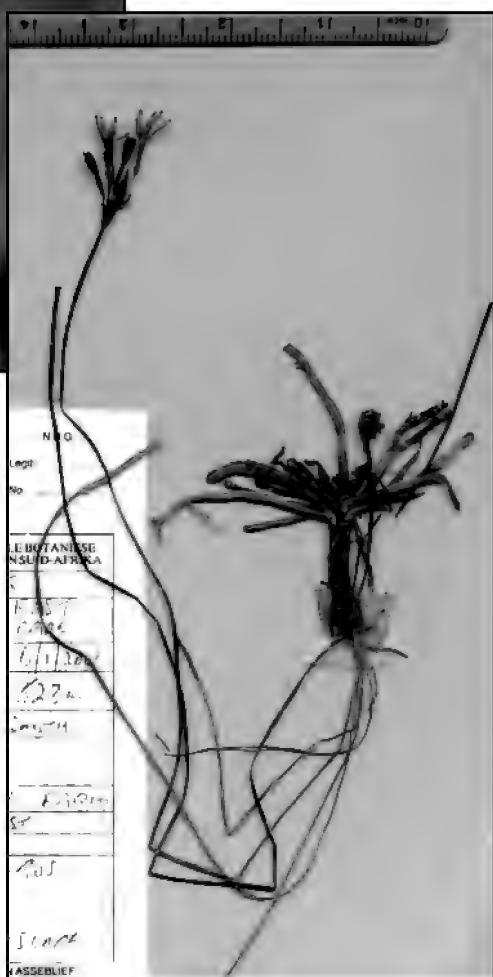


Fig. 4. Photographic representation of the type specimen (J.C. McMaster 120) of *T. violacea* Harv. subsp. *macmasteri* Vosa lodged in the Selmar Schönland Herbarium (GRA), Rhodes University, Grahamstown.

CRINUM PRONKII LEHMILLER, SP. NOV.
(AMARYLLIDACEAE)

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INTRODUCTION

Olaf Pronk, a Dutchman residing in Antananarivo, Madagascar, operates an export nursery specializing in orchids and succulent plants. He has widely diverse interests within the realms of Malagasy flora, trees, bird lore, reptiles, fish, and invertebrates, and it is a fascinating experience to visit his home and to view his collections. He has posted a series of interesting photo albums on the Internet at:

<http://community.webshots.com/user/OlafPronk?action=publicAlbums>.

Pronk, always alert to the possibility of encountering new or unusual indigenous plants during his travels, has helped to introduce a large number of new plants into cultivation including several *Crinum*. So it was as he was driving east of Ambilobe during the summer of 2006 when he spied an unusual appearing *Crinum* at the foot of a hill; the plants looked “different”. He collected a small quantity of bulbs and recorded a few notes regarding the collection site: The bulbs were growing in fine sandy soil among tall grasses in a near full-sun exposure. Other plants of horticultural interest occurring at the same site included an *Adenia* species and a *Begonia* species. Pronk sent several of the *Crinum* bulbs to the author for identification; subsequently they proved to be an undescribed species.

***Crinum pronkii* Lehmiller, sp. nov.**

Species *Crinum mccoyi* affinis, sed foliis et umbellis minoribus differt.

Type: **North Madagascar.** 2 km east of Ambilobe along the road to Vohemar. Bulbs originally collected by Olaf Pronk in 2006 and subsequently cultivated in Southeast Texas, May 2009, Lehmiller 1953 (Holotype: TAMU).



Fig. 1. Illustration of *Crinum pronkii* Lehmler including fruit by Kristin Jakob.

DESCRIPTION:

Bulb globular, covered with a brown papery tunic, 6.0-6.5 cm in height and 6.0-6.5 cm in diameter, with a short underground neck 2.5-3.0 cm long, occasional offsets noted in cultivation. Leaves 12-14, arising at ground level without a pseudostem, forming a low arching to flattened rosette with older mature leaves eventually lying on the ground, widest at the base and tapering into elongated slender pointed tips on new leaves, weakly channeled with older leaves becoming essentially flat, mild midline thickening without a depressed midrib effect, non undulate, margins entire, faint longitudinal parallel grooves visible on both surfaces, containing tiny wooly fibers when torn apart, shiny green, maximum length 35-40 cm, maximum width 2.5-2.7 cm. Scape arising from between lower leaves, dull red color throughout, compressed and eventually becoming almost two edged during fruit development, 20-24 cm long. Spathe composed of 2 principal bracts, spreading at anthesis, green with reddish streaking, 5.2-6.0 cm long by 1.3-1.4 cm wide. Umbel 2-3 flowered; flowers zygomorphic, sessile to weakly subsessile, opening at night, faint pleasant scent. Buds initially erect, inclining to near horizontal the day before anthesis, and then arising to vertical at anthesis. Ovary dark green, 7 mm long by 4 mm wide. Perianth tube straight at anthesis, light green color, 5.5 cm long. Segments broadly lanceolate, white with faint pinkish streaking of midline dorsal surface, unequal with the outer segments slightly broader, weakly dorsa flexed, 3.7-4.0 cm long by 1.4-2.0 cm wide, with small green apiculates on the outer segments and tiny white apiculates on the inner segments. Filaments very short, white, unequal with the inner longer, the inner 4 mm long and the outer 2 mm long; anthers eccentrically inserted, dark colored approaching black at anthesis; pollen golden yellow. Style non emergent, located 1.5 cm below the throat opening of the flower, purplish; stigma with tiny capitate effect. Fruit globular with a short apical rostellum 8-9 mm long, fruit becoming a shiny reddish green color during development, 2.1 x 2.0 x 1.8 to 2.3 x 2.1 x 1.8 cm in size, indehiscent; seeds 6-7 per fruit, generally ovoid to slightly compressed by adjacent seeds, pale dull green, 0.9-1.6 cm in diameter.

Habitat: Occurring in fine sandy soil at the foot of a sparsely vegetated hill among tall grasses, with mostly full sun exposure. Known only from a single locality.

DISCUSSION:

Crinum mccoyi Lehmiller (2003-2004) was originally described from a small localized population near Ambatofinandrahana. Since then a separate population has been discovered per Pronk, and the location of this site is being withheld to protect it from bulb collectors. The second site harbors bulbs that are somewhat larger than the type locality, and within the latter, umbels as large as 10 flowers have been noted, extending the original description of 1-7 flowered umbels to 1-10 flowered umbels.

The species with closest affinity to *C. pronkii* is *C. mccoyi*, and a comparison of leaf shape and configuration is depicted in Fig. 5. Although also growing in a rosette pattern without a pseudostem, the leaves of *C. pronkii* do not exhibit the higher arching pattern of *C. mccoyi*. Individual leaves of *C. pronkii* are not as channeled as those of *C. mccoyi* nor are they as long, and most importantly, leaf margins are entire in *C. pronkii* whereas they are denticulate in *C. mccoyi*. The smaller umbels (2-3) of *C. pronkii* also set it apart from *C. mccoyi*. At anthesis, flowers of *C. pronkii* are erect with straight perianth tubes whereas flowers of *C. mccoyi* are displayed above the horizon by curved perianth tubes and are not erect. Individual flowers of both species display the unusual pattern of very short filaments (Fig. 9) and non-emergent styles, with petals of *C. pronkii* being shorter and relatively broader than petals of *C. mccoyi*.

The site localities of *C. pronkii* and *C. mccoyi* are widely separated, being circa 900 km apart in straight-line distance; *C. pronkii* occurs in far north Madagascar, whereas *C. mccoyi* is found in central southeast Madagascar. The corresponding habitats and climate conditions are quite dissimilar; *C. pronkii* occurs in a coastal lowland region (higher rainfall) at an elevation of circa 100 m, whereas *C. mccoyi* occurs in the Itremo Mountain region at an altitude of circa 1450 m (lower rainfall).

ACKNOWLEDGEMENTS

Botanical artist and IBS member, Kristin Jakob of Valley Mills, California, is gratefully acknowledged for the type illustration.

All photographs by the author.

REFERENCE

Lehmiller, D.J. 2003-2004. Two new species of *Crinum* (Amaryllidaceae) from Madagascar. *Herbertia* 58:111-121.



Fig. 2. (Above) *Crinum pronkii* in bloom, May 2009.

Fig. 3. (Below) Type specimen of *Crinum pronkii*
Lehmiller, Lehmiller 1953, May 2009.





Fig. 4. Flowers of *Crinum pronkii*.



Fig. 5. Comparison of *Crinum pronkii* (left) versus *Crinum mccoyi* (right).



Fig. 6. Bulb of *Crinum pronkii*.



Fig. 7. Near mature fruit of *Crinum pronkii*.

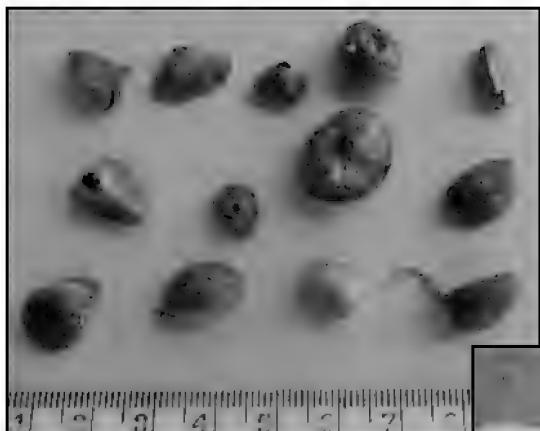


Fig. 8. (Above) Seeds of *Crinum pronkii*.

Fig. 9. (Below) Partial flower of *Crinum pronkii* to demonstrate the very short filaments.



THE GENUS RAUHIA

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The Amaryllidaceae of South America are represented by few modern and accessible taxonomic reference works. This is especially lamentable in light of the diversity of genera and species on the continent and has remained true even as our understanding of their phylogeny has greatly improved (Meerow et al., 2000). Relationships have been better elucidated while the longer task of revisions and monographs remains to be undertaken. Though these bulbous plants have been known or at least coveted by horticulturists for decades, for many of the genera no critical overviews exist and much of the relevant literature of the last 50 years is scattered in publications that are not easily accessible. Exceptions include *Eucharis* (Meerow, 1989), *Eucrosia* (Meerow, 1987) and the amaryllids of Ecuador (Meerow, 1990), but major entities such as *Stenomesson*, *Clinanthus* and *Hippeastrum* remain poorly known at the species level in spite of their botanical interest and importance to horticulture. A host of smaller genera such as *Grifflinia*, *Paramongaia*, *Eustephia* and others have long elicited interest among fanciers of greenhouse bulbs, and the genus *Rauhia* finds a home among such a grouping of curious and alluring geophytes. This paper focuses on our present knowledge of *Rauhia* in terms of its botanical and horticultural standing and on methods of cultivation.

Much of South America's biodiversity is the result of the relatively recent geological folding process that has resulted in the formation of the Andes Mountain Range. The valleys and ridges all along this continental chain, from near sea level to areas of year round snow, have provided generous opportunities, well exploited, for life to flourish. In particular, in the tropical and subtropical parts of the Andes where rainfall is distinctly seasonal and the climate is mild, bulb life has evolved diverse and splendid forms. A peculiarity of this bulbous flora is that it is represented almost exclusively by amaryllids and irids. *Hyacinthaceae* and geophytes in other petaloid monocot groups are nearly absent.

Three valleys in particular are home to the small yet remarkable genus *Rauhia*. The Río Utcubamba and Río Huancabamba both flow into the Río Marañón, a major artery that drains part of northeastern Peru and deposits its burden in the Amazon basin. A portion of the territory these rivers traverse at middle elevations is hot and dry, with a climate of modest rainfall alternating with a season that is rainless and dusty. On steep rocky slopes between elevations of 300 to 2000 m (mostly at about 1000 m), in the departments of Amazonas and Cajamarca, four or five *Rauhia* species occur. Their companions in this area of tropical dry forest include arborescent cereoid cacti as well as smaller cacti such as *Opuntia* and *Melocactus*, and various leguminous trees among a wealth of other flora. *Rauhia* habitat extends to more mesic semi-deciduous forest at least in the case of *R. decora* (Ravenna, 1981). The larger canopy plants in these habitats can provide shelter for the rauhias during the growing season, allowing them the luxury of producing their broad and succulent yet brittle and seemingly vulnerable leaves with generous surface area. In the dry season most overhead leafy protection vanishes with the rains and the bulbs follow suit to avoid the desiccating sunlight and heat.

The genus name aptly commemorates the achievements of Dr. Prof. Werner Rauh (1913-2000) of the University of Heidelberg. Rauh made extensive expeditions to many tropical areas and to the drier regions of Brazil, Peru and Madagascar in particular. As part of his academic studies Rauh brought back many hundreds of living specimens and built up the renowned living collections at Heidelberg over several decades. These research collections were and continue to be an important resource for scientific work as well as a distribution point of significance to horticulture, a field to which Rauh was well known to be sympathetic and generous.

Members of the genus *Rauhia* are characterized by having bulbs often large (to 20 cm diameter) and wider than tall, with dark brown, papery tunics. The leaves are paired and obscurely to conspicuously stalked, generally large (to over 30 cm long and about as wide), succulent, and brittle; they persist for one or several seasons and may be glaucous or glabrous. Leaf blade shapes include oblanceolate to obovate, spatulate or elliptic, and concavo-convex or “folded” with the margins held over the upper surface. Often there appear two dark creases that mark the vernation or folding of the leaves before they have emerged. This appears

to be a distinctive, though not consistent, character for the genus. The inflorescence is solitary and is borne between the new leaves, with a subterete and solid scape. Flowering generally occurs just as the leaves of the new season make their appearance. Each umbel bears a few to upwards of twenty pedicellate flowers that are pendent to spreading (nearly horizontal), with a more or less tubular to funnelform, green to whitish green or yellowish perianth. The perianth may be “actinomorphic or zygomorphic” (Meerow & Snijman, 1998) with stamens “straight and barely exserted” or “declinate-ascending and long-exserted” respectively. A staminal corona (cup) is absent. The stigma is capitate. Overall, the inflorescence exhibits glaucous qualities in most structures, including the perianth, even when the leaves are glabrous. Nectar is produced in copious amounts and combined with floral display and basic flower morphology this suggests a hummingbird pollination syndrome. The blocky capsules and flat black seeds are typical of most genera in the tribes Eucharideae (*Stenomesson*, *Phaedranassa*) and Clinantheae (*Clinanthus*), and similar to those of *Hippeastrum* (Figs. 6 & 16).

The relationships of *Rauhia* appear to be within a group of petiolate-leaved species (tribe Eucharideae), inclusive of *Stenomesson* as well as *Eucrosia* and, in particular, *Phaedranassa* (Meerow, 2000). Regarding the tribe Stenomesseae, Meerow writes that “*Stenomesson* Herbert may be paraphyletic, as cladistic analyses suggest that the monophyletic subgroup with reduced staminal connation comprising *Phaedranassa*, *Rauhia* and *Eucrosia* may have arisen from the petiolate-leaved species of the former” (Meerow, 1987). Having evolved in relative isolation in warm, dry inter-Andean valleys, the species of *Rauhia* can be considered to be specialized, succulent members of this distinctive group.

RAUHIA MULTIFLORA

The nomenclatural saga of *Rauhia multiflora*, the type species of the genus, is a rather complex and interesting one. In 1957 Dr. Hamilton P. Traub proposed the new genus *Rauhia* to honor Rauh, who had made a collection of this species in 1956 near Jaén in the Department of Cajamarca in northern Peru. Based on living material sent by Rauh to Traub under *Rauh P329*, Traub named the plant *Rauhia peruviana* (Traub, 1957). The type specimen, *Traub 535a*, is a unicate, or singular specimen, deposited at Missouri Botanical Garden. However, no original field voucher has

been located with Rauh's "P329" designation (Leuenberger & Arroyo-Leuenberger, 2006). Many years subsequent to this gathering, Rauh collected the species again under *Rauh 20399* and this was also introduced to cultivation. It has been cultivated under this number at Grigsby's Cactus Gardens in Vista, California, since the 1970s and possibly represents much of the material that is widely cultivated today, usually under the persistent synonym *R. peruviana*. A further possible point of origin for cultivated *R. multiflora* encountered in the U.S. is a collection by Paul C. Hutchison (*Hutchison no. 3574*) received in 1964 at Honolulu Botanical Gardens as seed under the name *Phaedranassa megistophylla*.

Later, in 1966, Traub discovered that the new plant had been previously named *Phaedranassa megistophylla* by Kraenzlin (1916) and made the necessary new combination *Rauhia megistophylla* (Kraenzl.) Traub. About the same time Ravenna (1967) had reached the same conclusion and published *Rauhia megistophylla* (Kraenzl.) Ravenna in the journal *Sellowia*. Finally, Ravenna (1969) realized that Kunth's *Phaedranassa multiflora* (Kunth, 1850) represented the same species as Traub's *Rauhia peruviana*, and since it was published earlier than Kraenzlin's name, he recombined the name to arrive finally at *Rauhia multiflora* (Kunth) Ravenna. The earliest collection known of *R. multiflora*, *Humboldt & Bonpland* 3582, was made near the site of Rauh's collection in Dept. Cajamarca, Prov. Jaén, Distr. Colasay. This historic collection by these two pioneering collectors luckily escaped the destruction visited upon the Berlin herbarium during World War II and serves as the type of *R. multiflora*. Leuenberger and Arroyo-Leuenberger (2006) provide an insightful discussion detailing further intrigues of the early herbarium history of this species.

Rauhia multiflora can attain impressive size when given free root run or planted-out in a warm climate. A healthy clump of plants is well established at the dry and hot Koko Crater, one of the sites of the Honolulu Botanic Gardens system in Hawai'i. Planted in part shade under shrubs, the leaves of these plants reach at least 45 cm long and over 30 cm wide. The bulbs are correspondingly large and could meet or exceed the 20 cm diameter noted by Rauh when he initially found plants in the wild. The inflorescence is a rather dense umbel of medium green spreading to pendent flowers with the stamens only protruding about 1 cm (Figs. 1 & 2).

Three additional species have so far been proposed in *Rauhia*. They are *R. decora*, *R. staminosa* and *R. occidentalis*, all published by Ravenna



Fig. 1. *Rauhia multiflora*, flowering plant of undocumented origin.



Fig. 2. *Rauhia multiflora*, flowers on plant of undocumented origin.



Fig. 3. *Rauhia multiflora*, bulb with new leaves and inflorescence emerging, plant of undocumented origin.

(1978, 1981, & 2002 respectively). Each of these proposed novelties remains poorly known as their documentation in the wild consists of little more than the type collection and access to these specimens has been problematic. However, it is happily the case that due to the diligent efforts of a few plant collectors, botanists and nurserymen alike, the first two of these three species can be said to be in cultivation. The third taxon, *R. occidentalis*, is unfortunately almost as obscure as the journal in which it was published.

RAUHIA DECORA

My own acquaintance with the genus *Rauhia* began in about 1980 when I saw plants at Grigsby's and possibly also at Abbey Garden Nursery. Then as now, these were exciting succulent bulbs with unique and striking features. In 1982, on a visit to The Huntington Botanical Gardens, I saw *R. decora* in one of the greenhouses, not with the succulents but in the tropical collections. The botanist for The Huntington at the time, Dr. James Bauml, was kind enough to share an offset of this beautiful plant, and I have grown it ever since. (The photograph in the IBS Gallery of Bulbs depicting a small clay pot with several bulbs is this same plant from The Huntington, still in its juvenile state, in my collection in San Diego about three years later.) At the time it was cultivated as "Phaedranassa sp," with locality data as follows: Peru, Dept. Amazonas, Prov. Bagua, canyon of Río Utcubamba, E. of Olomas, 820 m alt., P. C. Hutchison (*Hutchison* 3799). Eight bulbs were collected originally and sent to Paul Weissich at Foster Botanical Garden, Hawai'i. Seedlings from the plants at Foster were sent to Elmer Lorenz in California in 1964 and subsequently made their way to The Huntington. Voucher specimens were deposited at the University of California, Berkeley. In 2008, an offering of seedlings originally derived from this same gathering was made by The Huntington Botanical Gardens through the International Succulent Introductions scheme under ISI 2008-27. The type collection of *R. decora* was made by Ravenna nearby, between Bagua and Chachapoyas.

Rauhia decora is at once distinct from *R. multiflora* by its dramatically outward-spreading flowers with long pedicels and long-exserted stamens (Fig. 4). The shape of the perianth is also distinctive in being more funnelform than tubular, with conspicuously spreading or reflexed tepals (Fig. 5). Vegetatively it is a smaller species, with bulbs to about 7 cm



Fig. 4. (Left) *Rauhia decora*, plant in flower, ex P. Hutchison 3799.



Fig. 6. (Below) *Rauhia decora*, seeds ready for dispersal, ex P. Hutchison 3799.



Fig. 5. (Right) *Rauhia decora*, flower, ex P. Hutchison 3799.



Fig. 7. *Rauhia decora*, juvenile leaf, ex P. Hutchison 3799.



Fig. 8. *Rauhia staminosa*, seedlings, ex H. van der Werff s.n.



Fig. 9. *Rauhia staminosa*, flowers, ex H. van der Werff s.n.

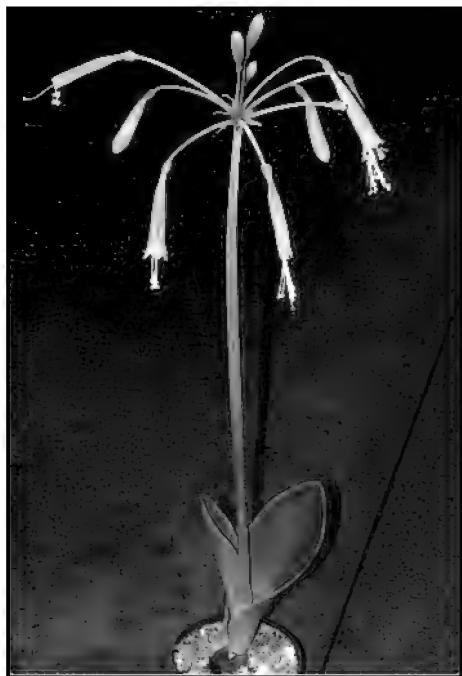


Fig. 10. *Rauhia staminosa*, flowering plant, ex H. van der Werff s.n.



Fig. 11. *Rauhia staminosa*, plants in habitat, ex H. van der Werff s.n. (Photograph by H. van der Werff.)



Fig. 12. *Rauhia staminosa*, plants in habitat, ex H. van der Werff s.n. (Photograph by H. van der Werff.)



Fig. 13. *Rauhia* sp. aff. *staminosa*, group of flowering plants, K. Knize 221.



Fig. 14. *Rauhia* sp. aff. *staminosa*, multiple bulbs in leaf, K. Knize 221.



Fig. 15. *Rauhia* sp. aff. *staminosa*, flowers, K. Knize 224.



Fig. 16. *Rauhia* sp. aff. *staminosa*, near-ripe capsules, K. Knize 224.

in diameter and leaves to about 25 cm long and 15 cm wide; the type description does not give dimensions of the leaf blades. The specific epithet “decora” is not referenced in the original description but may have been inspired by the juvenile leaves, which are dark green attractively flecked with silver (Fig. 7). The mature leaves are lighter green and lose much of this contrasting color effect, apparently by the progressive dominance of the silver coloration as the leaf blades mature rather than by a loss of the silver quality. Plants offset regularly, thus the more attractive juvenile decorative leaves can be enjoyed most of the time.

The behavior of this plant in cultivation reflects its semi-deciduous forest habitat. It grows reasonably well in heavy shade and exhibits bleaching of the leaves under greenhouse conditions that are too bright and hot. Moderate shade year round suits it ideally. *Rauhia decora* tends to be evergreen in cultivation and can retain leaves for 2-3 years.

RAUHIA STAMINOSA

This, the second species of *Rauhia* to be formally recognized, is similar in some ways to *R. decora*, and according to Ravenna (1981) the ranges of these two species “almost overlap”. It is likewise a smaller species than *R. multiflora* and may be distinguished especially by the spreading position of the flowers and the long-exserted stamens (Fig. 9). The leaves are somewhat variable in shape and color; they may be folded and light green or slightly glaucous and nearly flat, and they are similar in size to those of *R. decora*.

Fortunately, two useful photographs of *R. staminosa* were published by Ravenna (1981), although these appeared with the description of *R. decora*, the latter not provided with any illustrations by the author, and well separated from its original publication three years prior in *Herbertia*. Live material collected by Dr. Henk van der Werff (*van der Werff s.n.*) between Bagua and Pedro Ruiz at 900 m elevation, appears to agree well with the plants depicted in those photographs (Fig. 10 & 11). The cultivated plants of this gathering represent at least three different clones, and there is some morphological variation among them. One especially vigorous clone offsets regularly and is evergreen and glabrous, and it resembles *R. decora*; another offsets sparingly or not at all and tends to be winter-deciduous, and its leaf blades are slightly glaucous. Seedlings from these plants (Fig. 8) share the silver pattern aspect of juvenile *R. decora* leaves to some extent.

RAUHIA SP. AFF. STAMINOSA

A group of plants obtained by the author on a 1997 visit to the nursery of Karel Knize (KK) in Lima, Peru, has some traits suggesting *R. staminosa* but also certain peculiarities that set them apart from what appears to be “typical” *R. staminosa* as represented by Ravenna’s photographs and description and the van der Werff collection. Knize is well known for his extensive explorations for cacti and xeric bromeliads in Peru over many years. These Knize rauhias were collected from three different areas, as related by Knize to the author at the time of his visit, of widely divergent elevations in the same watershed.

The three collections are KK 220 (“Balsas, 1000 m”), KK 221 (“Bagua, 600 m”) and KK 224 (“Chachapoyas, 2000 m,”); two of these are depicted in Figs. 13-16. These collections are characterized by their small overall size, distinctly petiolate leaves with rounded and prominently glaucous blades (Fig. 14), yellowish flowers with stamens exserted 1-2 cm and their tendency to have a well-defined leafless dormant period through winter. The flower morphology varies between the different Knize numbers, as would be expected in material from such disparate localities (Figs. 13 & 15). In general the inflorescence is compact and the flowers are more pendent than spreading. Seedlings thus far generated from the Knize plants exhibit unmarked glaucous leaves rather than the silver-decorated, glabrous seedling leaves of *R. decora* and *R. staminosa*. The taxonomic disposition of these plants and a better understanding of *Rauhia* in toto will be arrived at only after more systematic exploration of the watersheds where they occur.

OTHER SPECIES

Dr. Abundio Sagástegui and Dr. Alan Meerow are in the process of describing a striking new species of *Rauhia* with greenish-white flowers (Fig. 17).

An unpublished name, *Rauhia sagasteguiana* Ravenna, appears on the Internet in some databases. This name cannot be considered as representing another *Rauhia* species until, and if, it is validly published.

NOTES ON GENERAL CULTIVATION

The cultivation of these extraordinary bulbs is not difficult provided a few key provisions are attended to. To summarize briefly, these plants



Fig. 17. *Rauhia* sp. nov., flowers of plants in habitat. (Photograph by Abundio Sagástegui.)

enjoy warmth year round, pot-bound or under-potted conditions at the roots, very well-drained potting mix, bright to moderate light, moderate humidity and a dry winter rest.

Considering that these plants grow in equatorial latitudes and often at lower elevations in hot, dry valleys, it should not be surprising that rauhias resent exposure to cold. In the summer when the bulbs are fully leafed-out, temperatures should be 65-75°F minimum with a maximum of 85-95°F; temperatures over 100°F are endured easily, especially under some shade. In winter, when the bulbs may be leafless or retain some older leaves, a minimum of about 55-60°F is suitable and warming during the day is desirable. Cooler temperatures can be tolerated if the soil and roots are perfectly dry. Bulbs in leaf in winter that are kept under warmer conditions (minimum 60-65°F) – which may promote leaf retention in dormancy in the first place – can be watered sparingly to encourage longevity of the leaves.

The potting mix should consist mostly of drainage material such as pumice or scoria (perlite can be substituted if necessary) at about $\frac{2}{3}$ of the total by volume, followed by sharp-draining coarse sand and only enough organic matter (to 15% of the total) to give the mix “body” and to hold the

other components together. This can be considered a very lean mix and is suited to xeric plants with a relatively coarse root system of thickened roots; *Rauhia* bulbs possess a perennial and rather substantial mass of succulent roots that persists through the dry winter dormant period. Alternatively, a simpler mix of only sand and organic material can also serve well but will not be as long-lived and more frequent repotting will be needed to avert the loss of roots. The longevity or durability of the potting mix should be considered for slow-growing plants such as *Rauhia*, and considering that they receive little water for 4-6 months out of the year, repotting to a larger container or to refresh the soil mix should only be necessary every 3-5 years. Plastic pots with at least one set of four drainage holes are recommended for warmer climates, while clay pots may be a better choice in more temperate zones.

Rauhias should normally be planted so that the upper portion or "shoulder" of the bulb is slightly exposed above the soil mix, or only slightly buried. The bulb can also be treated like a caudex and exposed about half way. Old tunics can build up a protective layer of insulation and only the oldest, loosest tunics should be removed. Once a root system is developed the bulb should be firmly secured in its container. If the bulb is at all loose to the touch or rocks easily, it should be removed and the roots inspected; a smaller pot may be necessary to start a new root system. All species of *Rauhia* thrive on being under-potted, that is, with roots and bulb fitting quite snugly in the container.

After winter dormancy a first watering can be given when signs of new growth are apparent. This will usually be a new pair of leaves, accompanied by an inflorescence if the bulb is large enough. It is important to avoid landing water in the "cup" formed by the newly emerging leaves as this can allow rot to develop in a nascent inflorescence or in the leaves themselves. Relatively soft, new leaves should be allowed to develop in good time and over-watering during this critical period should be avoided. Applications of water should always be thorough and well spaced, allowing substantial drying-out of the potting medium in between waterings, even during periods of active growth. Over-watering and cold, especially in combination, are the main contributors to premature mortality in *Rauhia*. These plants do not seem to be particularly fussy about water quality.

Light needs vary depending on the species. *Rauhia decora* seems to need shade year round to avoid bleaching or yellowing of the leaves. Heat

combined with bright light may have an especially detrimental effect on leaf color and perhaps leaf longevity. While this species can be maintained in deep shade, where the leaves will look attractive, it may not flower without more light. Its smaller size and lower light demands make it an excellent houseplant candidate. *Rauhia staminosa* also appreciates a little shade, while the thicker-leaved and robust *R. multiflora* and any glaucous-leaved *Rauhia* seem more adapted to bright light and heat. These species will also grow in more shade but may not flower or produce strong and characteristic leaves. These lighting guidelines are only approximate and depend on the "plant sense" of the grower and local conditions.

Species of *Rauhia* are not "desert plants" and so need some humidity to prosper. During growth it should be about 40% minimum and up to 80%. Again, these are indicative figures and are only meant to give an approximate idea of suitable conditions for growth. Humidity figures in particular can vary outside this recommended range without harming the plants. In the dormant period, lower humidity (below 50%) can help ward off some potential disease problems.

The robust root systems of *Rauhia* species give some indication of their amenability to, or need for, regular fertilizing. A formulation that is especially helpful for many amaryllids contains nitrogen that is mostly comprised of nitrate with only a small percentage of ammonia or urea nitrogen. Many commonly available formulas designed for orchids are so proportioned. A foliage formula should be used most often, at regular strength or a little less, alternating occasionally with a bloom formula, with a good flush with only plain water every fifth watering or so. So-called "balanced" formulations should be avoided since they are not ideal for vegetative or floral development in these plants. With a proper feeding regimen, mature, healthy bulbs should be expected to flower at least every 2-3 years and sometimes successively for several years when plants are well established.

Propagation starts with pollinating the flowers, and as with many amaryllids there is variation between species or clones with regard to self-compatibility. Fortunately it is the case that rauhias are more often self-compatible, but stronger development and more seeds can be expected if different clones are crossed together. A brush can be used for pollination or just as easily the stamens can be grasped gently and brought into contact with the stigmas; the latter are receptive as the stamens are wilting.

The large flowers produce plenty of pollen and the stigmas are sticky when receptive for pollination, thus facilitating trouble-free artificial pollination. Capsules mature in about two months and split open to reveal neatly stacked rows of spongy, flat black seeds (Fig. 6). Seed sowing is straightforward and can be carried out by floating the seeds on water and planting when a root initiate is present or by direct sowing with a light covering in a suitable mix. A good general seed-sowing mix consists of about $\frac{1}{2}$ perlite, $\frac{1}{4}$ sharp sand, and $\frac{1}{4}$ peat moss. When sowing, covering and firm tamping are complete, the mix should be thoroughly watered from above and soaked from below for an hour or two. A final covering of fine gravel will help keep the mix in place and keep the surface dry to deter algae and fungus gnats. Granite gravel (grade 10 or 12), often used as chicken feed, has the added advantages of transmitting light and providing some mineral nutrition to the seedlings. Keep the planted seeds warm and humid – a sealed plastic bag works well but must be opened as soon as green sprouts appear. Gentle fertilizing helps seedlings at all stages. From seed to flowering can take roughly 5-6 years under good conditions.

Conventional vegetative propagation of rauhias is simple and involves dividing plants when they have produced offsets of sufficient number and size. Once offsets are a few centimeters in diameter they tend to separate naturally from the mother bulb. However, not all clones of certain species produce offsets, even after more than a decade of growth.

Diseases and pests in *Rauhia* seem to be few. Certain mealy bug species are notoriously partial to amaryllids but they are not especially problematic for rauhias. While viruses such as amaryllis mosaic virus are always a potential threat, the author has never seen indications of virus in *Rauhia*. Most ailments that occur in the cultivation of these bulbs are fungal or bacterial rots that are cultural in origin and can most commonly be traced to some combination of over-potting, where the plants must contend with a relatively large mass of moist soil that does not dry quickly enough, and over-watering or watering at the wrong time.

SUMMARY

It may be fairly said that the *Rauhia* species are among a small number of bulbs that are truly succulent by virtue of their foliage. They are not “somewhat succulent” or merely “fleshy” but genuinely thick-leaved, xeric geophytes. Because of this unique feature and the striking size and

shape of the leaf blades, as well as their engaging flowers, rauhias must have captivated the first collectors who brought them to the attention of science: Humboldt and Bonpland, Weberbauer, and or course Rauh himself. Today they are no less intriguing yet for the decades they have been in our collections they are not widely familiar to collectors of either succulents or bulbs. It is the author's hope that this brief overview will encourage others to grow and to propagate members of the genus *Rauhia* on a wider scale so that a larger audience can enjoy these plants. Similarly, the imperfect knowledge of the species of this remarkable genus hopefully will inspire field and laboratory work so as to arrive at a more satisfactory understanding of their relationships and natural history.

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All photographs by the author unless otherwise specified.

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LACHENALIA BREEDING

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(Translation provided by Helen Marriott of Australia.)

I became interested in *Lachenalia* over 50 years ago. I was in my late teens when I checked all the pages on bulbs in a horticultural reference book (that was published in Japan for the first time), and there I read an article on *Lachenalia* breeding. The article/section was written prior to World War I by a horticultural specialist, Mr. Omi Hirose, and I enjoyed reading it. The author wrote about *Lachenalia* breeding being rare and without parallel in the world. He also introduced some techniques for breeding using mixed pollen. (This breeder also bred *Nerine* and he thought that his breeding outcomes were probably the best in the world, exceeding breeders in the United Kingdom at the time, but he died during the war.)

At the time when I read about *Lachenalia*, these bulbs were extremely rare in Japan. I was concentrating on breeding *Gladiolus* and when my first *Gladiolus* flowered, I sent cut flowers to a flower exhibition in Tokyo. There I met a *Gladiolus* breeder and learned that he also had *Lachenalia*. He only had *L. aurea* and *L. pendula* but I strongly requested him to let me have some of his *Lachenalia*. However, he only sent me seed and these were shiny black and very small. Perhaps it was because I was a beginner, but in the end none of those seed germinated.

A few years later I was able to purchase bulbs of both *L. aurea* and *L. pendula*, and eventually I was able to obtain bulbs from the Van Tbergen Company in Holland of *L. contaminata*, *L. mutabilis* and *L. tricolour*. At first I started breeding these bulbs by crossing them together. Some years later I was able to buy species seed from the South African Botanical Society.

Lachenalia has almost 80 species and among these there are many different colour varieties and flower shapes. Some are upright, others are pendulous or half erect, and some are fragrant. They also bloom over

about one-half of the year, from November until the beginning of May in the Northern Hemisphere. The leaves also possess many different characteristics, including cylindrical shapes, broad leaves, pustules on the leaves, and variegated purplish leaves. When we consider all the possible variations in these characteristics, *Lachenalia* breeding can involve an infinite number of combinations.

At the beginning of my breeding I focused upon the breadth of the flowering season, and I saved the pollen of the early flowering varieties in the refrigerator to cross with those which flowered later. However, then I discovered that when the flowers bloomed from March onwards, they tended to be overpowered by other colourful flowers, so now I am concentrating on breeding *Lachenalia* which flower before February.

Any sort of breeding is acceptable for the amateur hobbyist, but from a business point of view, it is necessary to think about various developments, such as breeding the dwarf type as pot plants on the one hand, and ones with long flowering stems for the cut flower market on the other hand. Whether they are dwarf or tall plants, during the long period from the beginning of the growth period until flowering, *Lachenalia* have a real attraction because their array of exquisite leaves and buds makes them look really fresh, unlike any other bulb.

In the case of potted plants, after we despatch them for sale, we have to propagate them again. So now I'm interested in pursuing hybrids to sell as cut flowers instead, and I want to develop a long flowering stem that is over 20 cm tall.

Lachenalia is still only a minor bulb, and it is not expensive as a cut flower in Japan, but while breeding them I can continue to propagate them and so continue hybridization of them. *Lachenalia* is one of the few bulbs that flowers in mid winter, and if it's protected from becoming frozen, it is easy to grow. Furthermore, there is a rare sky blue colour that is not found in other bulbs, and they also have a nice fragrance. *Lachenalia* thus give me inspiration with regard to their future breeding potential.



Fig. 1. Growing area for *Lachenalia* and other bulbs.



Fig. 2. *Lachenalia aurea* × *Lachenalia tricolor* hybrid.



Fig. 3. *Lachenalia carnosa* × *Lachenalia quadricolor* hybrid.



Fig. 4. *Lachenalia roodii* × *Lachenalia rubida* hybrid.



Fig. 5. *Lachenalia* 'Haru no Kane'.



Fig. 6. *Lachenalia aurea* x *Lachenalia tricolor* hybrid.



Fig. 7. *Lachenalia* 'November Fantasy'.



Fig. 8. *Lachenalia* tricolor.



Fig. 9. *Lachenalia* breeding room.



Fig. 10. *Lachenalia* breeding room.



Fig. 11. Breeding stock of *Lachenalia* species.

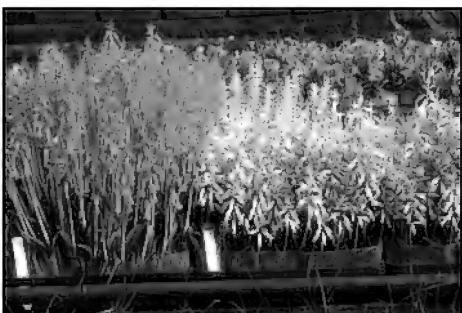


Fig. 12. *Lachenalia* hybrids.



Fig. 13. *Lachenalia* 'Haru no Enbi'. (*L. vanzyriæ* × *L. tricolor*)



Fig. 14. *Lachenalia* vanzyriæ × *Lachenalia* viridiflora hybrid.



Fig. 15. *Lachenalia* 'November Blue'.



Fig. 16. *Lachenalia* 'Yuki Boushi'.



Fig. 17. *Lachenalia viridiflora* × *Lachenalia rubida* hybrid.



Fig. 18. *Lachenalia viridiflora* hybrid.



Fig. 19. *Lachenalia glauca* × *Lachenalia viridiflora* hybrid.



Fig. 20. *Lachenalia* 'Haru no Hiyori'.



Fig. 21. *Lachenalia aurea* × *Lachenalia tricolor* hybrid.

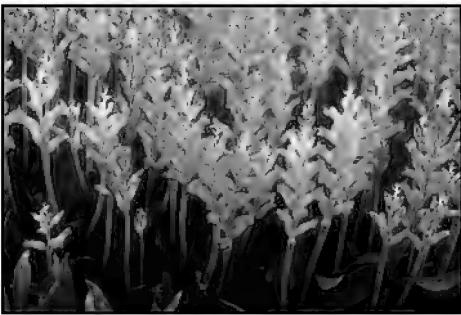


Fig. 22. (*Lachenalia alba* × *Lachenalia bulbifera*) × (*Lachenalia aurea* × *Lachenalia reflexa*) complex hybrid.



Fig. 23. *Lachenalia arbuthnotae* × *Lachenalia tricophyra* hybrid.

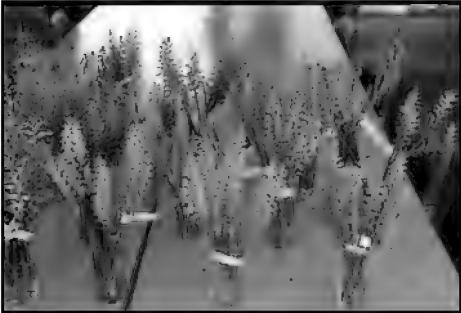


Fig. 24. Sample of *Lachenalia* as cut flowers.

MCKEAN'S HYBRID DOUBLES - UNIQUE *HIPPEASTRUM* WITH MULTIPETALLED FLOWERS

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ABSTRACT

McKean's Hybrid Doubles are unique *Hippeastrum* cultivars with multipetalled flowers. Cytogenetic and molecular analyses of these cultivars were previously reported by researchers at the National Botanical Research Institute, Lucknow. The present investigation supplements the previous reports on McKean's Hybrid Doubles and provides details of their morphological and anatomical characters.

Key words: *Hippeastrum* 'McKean Hybrid', double hybrids, anatomical and morphological features.

INTRODUCTION

Hippeastrum is a bulbous ornamental plant belonging to family Amaryllidaceae. The genus has around 60 species and more than 600 hybrids. Plants are indigenous to the Americas. They are native of tropical and subtropical regions from Argentina, north to Mexico and the Caribbean (Traub and Moldenke, 1949). These plants are popularly but erroneously known as *Amaryllis*, an African genus in the same family. Most *Hippeastrum* hybrids come from Dutch and South African sources. New hybrids are now being developed in Australia, Brazil, Israel, Japan, United States and India. Hybrid plants require plenty of water and fertilization during the growing period as this will encourage the development of large flowers.

National Botanical Research Institute (NBRI), Lucknow has been a pioneer organization in the field of ornamental crops for over four decades and has maintained a rich germplasm of different ornamental plants including *Hippeastrum*. An extensive investigation of *Hippeastrum* hybrids was initiated at NBRI by Dr. T.N. Khoshoo (1971), a pioneer in

the classification and understanding of hybridization in *Hippeastrum*. In a cytogenetic survey, Narain (1977a) identified ten major ancestral species which seemed to be involved in the origin of *Hippeastrum* garden cultivars through hybridization and selection. Narain (1977c) found that *Hippeastrum* was monobasic ($n = 11$), with polyploids ranging from $3n$ to $7n$. Narain and Khoshoo (1977) concluded that hybridization was the most important factor in the origin of garden cultivars of *Hippeastrum* and proposed a phylogenetic tree to explain the origin of *Hippeastrum* cultivars.

Hippeastrum cultivars have unique flowering features; i.e., the double flowers from Japan are particularly beautiful and Dutch hybrids usually produce flowers first and then vegetative growth starts after blooming. Different species of *Hippeastrum* show wide colour ranges. The majority of the cultivars have single flowers with six tepals which are arranged on the flower in two whorls of three tepals each. On the basis of flower morphology and type, *Hippeastrum* hybrids are classified into five categories: viz. Single, Double, Miniature, Cybister and Trumpet.

Cytogenetic and molecular characterizations of different *Hippeastrum* germplasm at NBRI was previously accomplished (Chakarborty et al., 2006, and 2007); these studies did not include morphology. The present morphological and anatomical investigations were carried out to understand McKean's Hybrid Doubles in a more precise way.

MATERIAL AND METHODS

Stomatal studies were carried out from upper and lower leaf epidermal peelings after staining in 4% silver nitrate solution. Stomata frequency, size of guard cells and pores, and size of epidermal cells were recorded (Table 1). The number of stomata (per unit area) was more in lower epidermis.

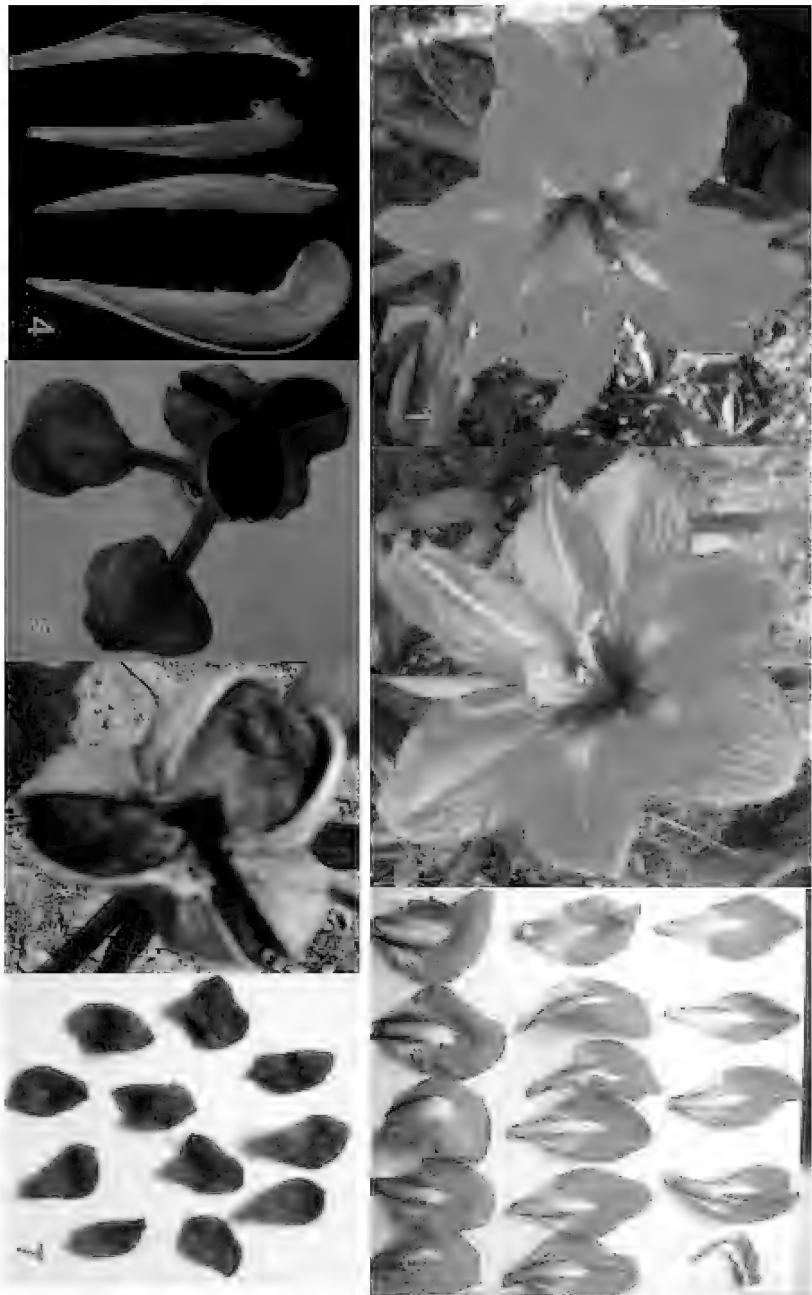
RESULTS AND DISCUSSION

McKean's Hybrid Doubles are unique *Hippeastrum* cultivars with multipetaled flowers. In the present investigation an attempt has been made to characterize the plants by recording their unique morphological data which is also supported by anatomical observations.

Morphological Studies

Flower Morphology: Two cultivars of McKean's Hybrid Doubles are

Explanation of plate: 1. McKean Hybrid double cv. red; 2. McKean Hybrid double cv. Red with white stripes; 3 & 4. Tepals of cv. 1 showing sex organs; 5&6. Seed pods with seeds; 7. Seeds.



available in our germplasm collection. The flower colour of *Hippeastrum* 'McKean Hybrid-1' is red (Red group 44A Fan-1; Fig. 1) while *Hippeastrum* 'McKean Hybrid-2' has ornate white stripes (White group 155 B, Fan-4; Fig. 2) which adds a different look to the flower. The size of the flowers (across) ranges from 12-13cm, and flowers are incomplete in nature due to the absence of male and female sex organs. These cultivars have multipetalled flowers with 17 tepals, while in normal cases flowers have only 6 tepals. The magnificent, large, funnel shaped flowers are borne on strong flower scapes. Flowers bloom in March – April under Lucknow conditions. Tepals are categorized on the basis of their size into three groups: small, medium and large, which range from 6 to 10 cm in length (Table 1). Male and female sex organs are highly disturbed in the flowers, and it is very difficult to identify them. Male reproductive organs; i.e., stamens, are absent from the flowers and only anther lobes are present at the margins of tepals (Fig. 3 & 4). Epipetalous condition is a very common phenomenon in these flowers. The female sex organ is represented by a single style, and in most of the cases it is absent from the flower. A stigma in most of the flowers is absent, and in rare cases it is present on the tepal surface as a dot-like structure (Fig. 4).

The plants attain heights up to 82 cm. Vegetative growth of the plants is clearly visible in foliage and can be easily measured by number of newly developed leaves and their growth performance. At the initial stage of bulb growth, few bulbs produce more than two sprouts, which clearly indicate the possibility of formation of more than one spike from a plant.

Mature plants produce 7 leaves (range 6-8) which emerge from the underground bulb. The plants produce long, strap like, rather fleshy, leaves. The emergence of the leaves from the ground is vertical in nature, and then they spread horizontally later on. Leaves are long and evergreen. The average length of leaves is 58 cm and average width is 4 cm.

The stem is modified into the bulb and its base remains underground. The bulbs are approximately 8.0 cm in diameter. The average length of the spike is 80 cm and its colour is green. The spike is fistular in nature and its diameter is 3 cm. Four floral buds emerge from each flowering stalk, and their orientation is at 90 degree angles, which ultimately results into placement of four flowers in four different directions.

These hybrids produce seed pods containing many winged seeds (Fig. 5 & 6). In the immature stage, the colour of the fruit is green (Fig. 5), and the

colour changes to grayish orange with maturity (Fig. 6). Height of the fruit is 2.6 cm and the diameter is 3.8 cm (Table 1). Seeds are enclosed in papery sheaths inside the three chambered fruit. Once the seed pod has ripened and has begun to split, the seeds are exposed. Each fruit chamber contains approximately 25 seeds. Seeds have shiny black, papery-sheath (wing) like structures (Fig. 7). The average length of the seed wing is 2.08 cm and average width is 1.60 cm. Average seed length is 1.50 cm and average width is 0.60 cm (Table 1). Colour of the seeds is black. If the sheaths are gently rubbed between two fingers, the actual seeds can be felt as hard inclusions slightly larger than a sesame seed.

Anatomical Studies

Anatomical studies have been carried out from the upper and lower surfaces of the leaves. The number of stomata is more on lower surfaces of leaf lamina. The size of epidermal cells, guard cells and pores of the upper surface stomata are larger in comparison to the lower surfaces (Table 1).

Morphological and anatomical studies carried out in two cultivars of *Hippeastrum* 'McKean Hybrid' will be very useful for breeders by selecting the desired traits on one hand, and on the other these findings can be utilized by the nursery men and growers in monochromatic soft landscaping.

ACKNOWLEDGEMENTS

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Table 1. Vegetative and floral characters of two cultivars of *Hippeastrum* 'McKean Hybrid'.

(A) Morphology	
Number of sprouts per bulb	1-(2)-3
Plant height (cm) ± SE	81.60 ± 1.99
Number of leaves	6-(7)-8
Size of leaves (cm) ± SE	
Length	58.10 ± 5.51
Width	4.30 ± 0.46
Diameter of spikes (cm) ± SE	3.06 ± 0.27
Number of flowers per plant	4
Length of flowers (cm) ± SE	11.80 ± 0.59
Flower size (across) (cm) ± SE	
(N-S)	13.80 ± 0.99
(E-W)	15.40 ± 0.96
Number of petals	
Small	2
Medium	5
Large	10
Size of small petals (cm) ± SE	
Length	6.25 ± 0.17
Width	1.40 ± 0.07
Size of medium petals (cm) ± SE	
Length	8.60 ± 0.26
Width	2.60 ± 0.16
Size of large petals (cm) ± SE	
Length	10.50 ± 0.20
Width	4.10 ± 0.19
Fruit height (cm) ± SE	2.60 ± 0.16
Fruit size (across) (cm) ± SE	3.80 ± 0.12
Seed wing length (cm) ± SE	2.08 ± 0.10
Seed wing width (cm) ± SE	1.60 ± 0.10
Seed length (cm) ± SE	1.50 ± 0.13
Seed width (cm) ± SE	0.60 ± 0.10

(B) Anatomical		(Upper surface of leaf lamina)
Guard cell size ($\mu\text{m} \pm \text{SE}$)		
Length	60.25 \pm 0.74	
Width	19.75 \pm 0.23	
Epidermal cell size (μm) \pm SE		
Length	327.50 \pm 17.12	
Width	34.50 \pm 0.98	
Number of stomata (mm^2) \pm SE	22.80 \pm 1.41	
		(Lower surface of leaf lamina)
Guard cell size ($\mu\text{m} \pm \text{SE}$)		
Length	55.25 \pm 0.96	
Width	17.25 \pm 0.42	
Pore size ($\mu\text{m} \pm \text{SE}$)		
Length	47.00 \pm 0.85	
Width	10.50 \pm 0.59	
Epidermal cell size (μm) \pm SE		
Length	226.00 \pm 15.05	
Width	226.00 \pm 15.05	
Number of stomata (mm^2) \pm SE	37.20 \pm 1.65	
(C) Colour of flower		
		McKean Hybrid-2 McKean Hybrid-1
Colour of petal	Outer	Red Group 44 A, fan-1 White Group 155 B, fan-4
	Middle	White Group 155 B, fan-4 Red Group 44 D, fan-1
	Throat	Yellow-Green Group 144 B, fan-3 Yellow-Green Group 145 B, fan-3
Colour of stigma		White Group 155 B, fan-4
Colour of anther lobe		Yellow Group 2 C, fan-1
Colour of style		White Group 155 D, fan-4
Colour of immature fruit		Green Group 139 C, fan-3
Colour of mature fruit		Grayed-Orange Group 177 C, fan-4
Seed colour		Black Group 202 A, fan-4



IN MEMORIAM:
THADDEUS MONROE HOWARD, JR., D.V.M.
December 28, 1929 – April 21, 2009

Heart attack, Methodist Hospital, San Antonio, Texas.

Father: Thaddeus Howard, Sr.; Mother: Lolita Comfort.

Attended Peacock Military Academy, San Antonio, Texas, 1937.

Graduated Brackenridge High School, San Antonio, Texas, 1947.

Attended North Texas Agricultural College, 1947-1949.

Attended Texas A&M University, 1949-1953.

Graduated 1953, with D.V.M. (Doctor of Veterinary Medicine).

Entered U.S. Army Veterinary Corps 1953; assigned to Fort Benning and

Fort Hood; attended Meat and Diary Hygiene School in Chicago 1953.

Worked as USDA poultry inspector 1955-1956, and meat inspector for city
of San Antonio, Texas.

Entered private veterinary practice 1956; San Pedro Animal Hospital, San

Antonio, Texas; belonged to A.V.M.A., T.V.M.A. and Bexar County

V.M.A.

Toy train collector; joined Train Collectors Association (T.C.A.) 1969.

Avid plant collector and into botany; bulb hybridizer and created many
new crinum and rain lily varieties.

Awarded the Herbert Medal by American Plant Life Society for botany
1970.

Built the new San Pedro Animal Hospital in Hollywood Park, San Antonio,
Texas, 1970.

Elected Secretary-Treasurer of T.C.A., 1986-1988.

Authored a book: Bulbs for Warm Climates, published by University of
Texas Press, U.T. Austin, Texas.

Made many field trips to Mexico to collect new plants, 1953-2003;
discovered more than 40 plant species new to science.

Also made trips to Guatemala, Brazil and Argentina to collect plants.

Retired from veterinary practice in 2000 and sold his practice to Acres
North Animal Hospital located across the street from his hospital.

Moved to Saint Hedwig, Texas, to continue his plant hybridizing and to
take young college students out on field trips who were into botany.

Helped with wildlife rescue and rehabilitation and helped to place
homeless dogs and cats with new owners.

Gave talks and slide presentations on plants and flowers to women's clubs
around the country when invited.

Editor's Note: Shortly before his death, Thad Howard dictated this obituary to his close confidant, Larry Zuercher. It was Thad's wish that his obituary be published only in *Herbertia*. Thad was an active member of the American Plant Life Society and International Bulb Society for 60 years. His autobiography was published in the 1970 *Herbertia* when we was awarded the Herbert Medal.

THAD HOWARD'S TAXONOMIC CONTRIBUTIONS TO MEXICAN *HABRANTHUS* AND *ZEPHYRANTHES*

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Thaddeus M. Howard, Jr., D.V.M., an avid collector, trader and hybridizer of amaryllids with an early love for plants (Howard, 1970), was appropriately named the 1970 Herbert Medalist "...for his outstanding contributions to the amaryllids, notably adding to the knowledge available on *Allium*, *Bessera*, *Sprekelia* and other genera" (Herold, 1971). We here recognize Dr. Thad Howard for further contributing in the finding and naming of 15 of the approximately 40 rain-lilies, *Habranthus* and *Zephyranthes* (Amaryllidaceae), native to Mexico.

In July 1954, a year out of veterinary school, Howard went on a collecting trip in Mexico (Howard, 1970). He found a yellow-flowered taxon at Mamulique Pass in the State of Nuevo Leon and sent bulbs to Hamilton Traub for identification. Nine years later, the plant was named *Zephyranthes howardii* Traub (1963). Howard later transferred the species appropriately to *Habranthus*: *H. howardii* (Traub) T.M. Howard (1990).

In 1964, Howard found a long-tubed, lightly-pink-flowered rain-lily in the state of Nuevo Leon. This taxon was named *Zephyranthes morrisclintii* Traub & T.M. Howard (1970). We believe that this interesting taxon will eventually be shown to be of hybrid origin involving taxa with a shorter-tubed primarily pink flower and a longer-tubed primarily white flower.

In the 1990 issue of *Herbertia*, Howard and Scott Ogden named six new rain-lilies from Mexico. In July 1953 - just after completing veterinary school (Howard, 1954 and 1970) - Howard collected *Zephyranthes reginae*

T.M. Howard & S. Ogden (1990) in the state of San Luis Potosí. In April 1962 in Nuevo Leon and Zacatecas, Howard discovered *Z. chichimeca*. T.M. Howard & S. Ogden (1990) [*Habranthus chichimeca* (T.M. Howard & S. Ogden) Flagg, G. Lom. Sm. & Meerow (2010)]. In June 1963, in the states of San Luis Potosí and Tamaulipas, Howard discovered *Z. nymphaea* T.M. Howard & S. Ogden (1990). In May 1986, in the state of San Luis Potosí, Howard and Ogden found *Z. primulina* T.M. Howard & S. Ogden (1990) [We believe this long-tubed, pale-yellow-flowered taxon, which has been collected in conjunction with long-tubed, white-flowered *Z. chlorosolen* (Herb.) D. Dietrich (1840), has a hybrid origin.]. In June 1987, in Coahuila, Howard & Ogden collected *Z. crociflora* T.M. Howard & S. Ogden (1990). In July 1987, near the Zacatecas-San Luis Potosí state line, Howard & Ogden found *Z. bella* T.M. Howard & S. Ogden (1990).

Additionally in 1990, Howard was the sole author of two other Mexican rain-lilies: *Habranthus vittatus* T.M. Howard (1990) found by Howard in Oaxaca in 1983, and *xCoobranthus coryi* T.M. Howard (1990), a natural bigeneric hybrid found by Howard in April 1963 in the state of Nuevo Leon "...in company with *Habranthus howardii* and *Cooperia pedunculata*."

In July 1991, Howard found *Zephyranthes leucantha* T.M. Howard (1993) in the state of Hidalgo.

In 1996 in Herbertia, Howard described four more Mexican rain-lilies. He found *Zephyranthes dichromantha* T.M. Howard (1996) in the state of San Luis Potosí in July 1991. *Zephyranthes moctezumae* T.M. Howard (1996) was collected in the state of San Luis Potosí near Tamazunchale by Mrs. Morris Clint about 1955. *Habranthus mexicanus* T.M. Howard (1996) was collected in the states of Hidalgo, Guanajuato, San Luis Potosí and Queretaro. The last rain-lily that Howard described, *H. oaxacanus* T.M. Howard (1996), he found in the mountains of Oaxaca. Of the 15 Mexican rain-lilies named by Howard, *H. oaxacanus* appears to be the only one that had been previously described: *Z. conzattii* Greenm. (1898) [*H. conzattii* (Greenm.) Flagg, G. Lom. Sm. & Meerow (2010)]. Howard was correct in assigning this species to *Habranthus*, but he was apparently unaware of the existence of C. Conzatti 98, 19 Apr 1896, Valley of Oaxaca (GH 30322), which Dr. W. S. Flory, Jr. (1978 Herbert Medalist) and R. O. Flagg annotated "HABRANTHUS 10 Feb 1962."

T. M. Howard, Jr., D.V.M. has described more than one-third of

the known Mexican rain-lilies. This taxonomic achievement is truly remarkable and is ready testimony to Dr. Howard's unflagging interest and to his acute powers of observation.

ACKNOWLEDGEMENTS

We particularly thank Dr. J. C. Solomon, Curator of the Herbarium of the Missouri Botanical Garden, for locating, mounting, labeling, and then lending us type specimens by T. M. Howard and by T. M. Howard & S. Ogden. We express appreciation to the Gray Herbarium for the digital loan of the holotype of *Z. conzattii* Greenm.

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A NEW MEXICAN *HABRANTHUS* (AMARYLLIDACEAE) AND A KEY TO THE *HABRANTHUS* OF MEXICO AND SOUTHWESTERN USA

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ABSTRACT

Habranthus tepicensis Greenm. ex Flagg & G. Lom. Sm., sp. nov. is described, and a key to the 11 *Habranthus* species native to Mexico and southwestern United States is presented with photographs.

INTRODUCTION

We are publishing a name that Dr. Jesse More Greenman recognized as a new taxon but did not publish. He was apparently employed at the Gray Herbarium (GH) of Harvard (1894-1899, 1902-1905) when he annotated the *Rose 1494* specimens. He studied in Berlin (1899-1901, PhD) and then returned to GH. He went from Harvard to the Field Columbian Museum of Chicago (1905-13), and then to the Missouri Botanical Garden in St. Louis (1913-51) (Woodson, 1951).

Habranthus tepicensis has been referenced in literature under the name *Zephyranthes tepicensis* at least four times: Hume (1935a and b), Sealy (1937), and Flory (1968). Hume stated in annotation (K, 28 July 1936) that the species had not been published; he proposed to do so under the same name. We will never know why the species was not validly published by Greenman or Hume, but it is distinct. We place it in *Habranthus*, because it has horizontal (not erect), arcuate mature anthers that are typical for the genus (Flagg et al. 2010, in press), and it has other characteristics that

we generally associate with most *Habranthus* including multiple length staminal filaments and a nodding flower.

***Habranthus tepicensis* Greenm. ex Flagg & G. Lom. Sm., sp. nov.**

Basionym: *Zephyranthes tepicensis* Greenm. nom. nud. Type: Mexico. Nayarit, Tepico, Acaponeta, 29 Jun 1897, J.N. Rose 1494 (holotype GH!, isotypes GH!, K!, US!).

Specimens examined:

Mexico. Nayarit, along Mexican Highway 15, about 10 miles south Acaponeta, 18 June 1959, Brewer and Mason 1776 (possible topotypes ARIZ, WFU).

Description:

Folia anguste linearia recombentia; spathe 2.1-3.6 cm longa, infra tubularis per 1/2-2/3 partes longitudinis; perianthum 3-6.5 cm longum infundibuliformae album vel subroseum, tubo viridi non longiore quam 1/6 partem totius longitudinis perianthii; stigma breviter lineare, ultra antheras 5 mm vel magis exsertum; antherae maturae horizontals (non erectae), arcuatae (lunatae), in gregibus duabus distinctis valde separatis (ut minimum 4 mm inter se distantibus) in dimidio superior perianthii dispositae.

Leaves narrowly linear, recumbent; spathe 2.1-3.6 cm long, $\frac{1}{2}$ - of the length tubular below; pedicel 1.7-3.6 cm long; perianth 3-6.5 cm long, funnelform, white or pinkish; perianth tube green, not more than 1/6 of the total perianth; stigma shortly trifid, linear, exserted at least 5 mm beyond anthers; mature anthers horizontal (not erect), arcuate (crescent shaped), in two distinct, well-separated sets (at least 4 mm apart) in the upper half of the perianth (Fig. 1 & 2). $2n = 22$ (Flory, 1968) (bulbs from Brewer & Mason 1776 collection, Flagg lab notes, 17 Apr 1962). Flowering in June.

Discussion:

Howard (1996) did a review of the six known Mexican *Habranthus* species including three which he had described: *H. mexicanus*, *H. vittatus* and *H. oaxacanensis* (= *H. conzattii*). He commented on some distinguishing characteristics including flower color, leaf type and scape height, and he also commented on distribution and habitats. Considering this new

species and the recent transfer of several species from *Zephyranthes* to *Habranthus* (Flagg et al., 2010 in press) it seems appropriate to present a key developed during our studies. This key is presented as a work in progress as it is based on studying herbarium specimens, some of which were of very limited numbers, and it could undoubtedly be greatly improved with field studies. Anthers and stigma are best observed in herbarium specimens by strong lighting behind the sheet as was done with Fig. 1, 3-10, and 12-13. Anthers of all rain-lilies are vertical (erect) in the bud, but turn to a horizontal position at maturity in *Habranthus*. Sometimes when the perianth has been laid open, the mature anthers of *Zephyranthes* will turn during pressing from erect to horizontal giving a false appearance of *Habranthus*. This is only a problem when the filaments appear to be subequal, as many *Habranthus* have filaments of multiple lengths as in *H. howardii* (Fig. 11).

ACKNOWLEDGEMENTS

We thank Phillip D. Jenkins (ARIZ), George F. Russell (US), Carolyn Beans (GH) and the Board of Trustees RBG (K, electronic) for making loans available. We are particularly indebted to Jim Solomon (MO) for extra efforts for locating Howard's types and authorizing the loan of those types, and to Mark Garland (<http://botanicallatin.org>) for the Latin diagnosis.

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All photographs by the authors unless otherwise indicated.



Fig. 1. *Habranthus tepicensis* (J.N. Rose 1494, GH).

KEY TO HABRANTHUS NATIVE TO MEXICO & SOUTHWESTERN USA

- 1a. Base of stigmatic trifurcation exserted at least 5 mm beyond uppermost mature anther.
 - 2a. Mature anthers in two widely separated sets of 3 (at least 4 mm apart).
..... *H. tepicensis* Greenm. ex Flagg & G. Lom. Sm. (Fig. 1).
 - 2b. Mature anthers not in two widely separated sets of 3.
 - 3a. Stigmatic lobes long (exceeding 4 mm).
 - 4a. Leaf narrow, not wider than scape.
... *H. conzattii* (Greenm.) Flagg, G. Lom Sm. & Meerow (Fig. 3).
 - 4b. Leaf broad, obviously wider than scape.
 - 5a. Perianth segments <2 cm wide
..... *H. mexicanus* T.M. Howard (Fig. 4).
 - 5b. Perianth segments >2 cm wide
..... *H. immaculatus* Traub & Clint (Fig. 5).
 - 3b. Stigmatic lobes short (not exceeding 4 mm).
 - 6a. Perianth segments yellow ... *H. concolor* Lindl. (Fig. 6).
 - 6b. Perianth segments pale pink with red stripes
..... *H. vittatus* T.M. Howard (Fig. 7).
 - 1b. Base of stigmatic trifurcation among or near (not exceeding 4 mm) mature anthers.
 - 7a. Stigma slightly above anthers; leaf not notably wider than scape.
 - 8a. Flower yellow. *H. tubispathus* (L'Her.) Traub (Fig. 8).
 - 8b. Flower not yellow
9a. Perianth length more than 4 cm.
..... *H. arenicola* (Brandegee) Flagg, G. Lom Sm. & Meerow (Fig. 9).
 - 9b. Perianth length less than 4 cm.
..... *H. chichimeca* (T.M. Howard) Flagg, G. Lom Sm. & Meerow (Fig. 10).
 - 7b. Stigma among anthers.
 - 10a. Perianth length >5 cm; leaf notably wider than scape
..... *H. howardii* (Traub) T.M. Howard (Fig. 11).
 - 10b. Perianth length <4 cm: leaf not notably wider than scape
..... *H. longifolius* (Hemsl.) Flagg, G. Lom Sm. & Meerow (Fig. 12, 13).



Fig. 2.
*Habranthus
tepicensis* (Brewer
and Mason 1776
collection)
flower not fully
mature in
cultivation at
The Blandy
Experimental
Farm.
(Photograph
by W. S. Flory,
1962).



Fig. 3.
*Habranthus
conzattii* (T.M.
Howard 92-4,
MO).



Fig. 4.
*Habranthus
mexicanus*
(L.C. Barnett et
al. 77A, TEX).

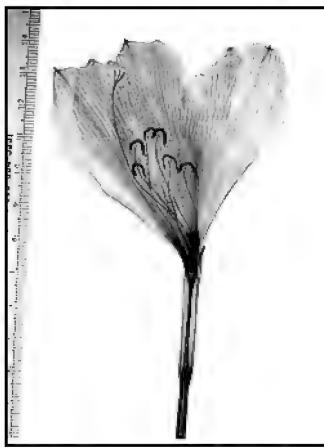


Fig. 5.
*Habranthus
immaculatus*
(Clint 610, ex
hort BEF 13162-
55, HPU).

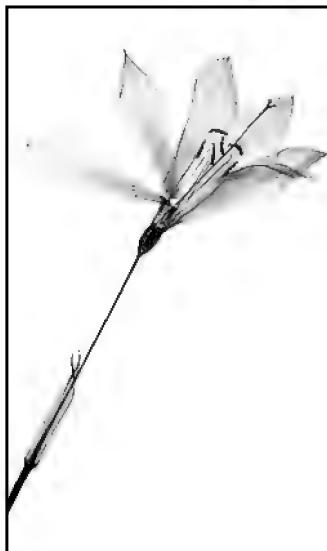


Fig. 6.
*Habranthus
concolor* not
quite mature
(Clint s.n., BEF
13183-54, HPU).

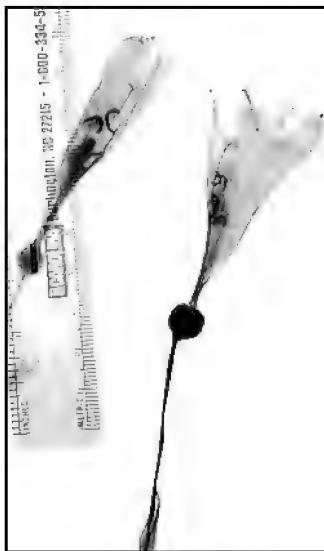


Fig. 7.
*Habranthus
vittatus* (Howard
& Ogden 83-25,
MO).

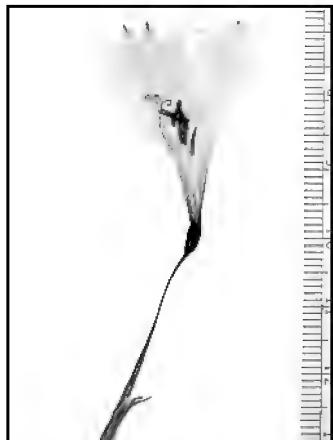


Fig. 8.
Habranthus tubispathus not quite mature (H.P. Traub 251, ex hort, BEF 14394-58, HPU).



Fig. 9.
Habranthus arenicola (R. Moran 9195, MO).

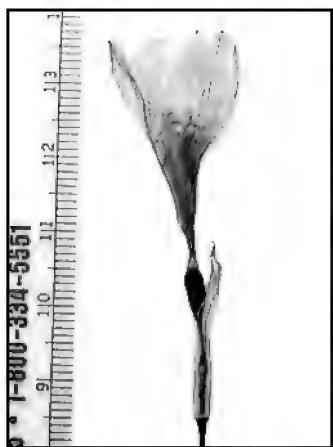


Fig. 10.
Habranthus chichimeca (Howard & Ogden 86-44, MO).

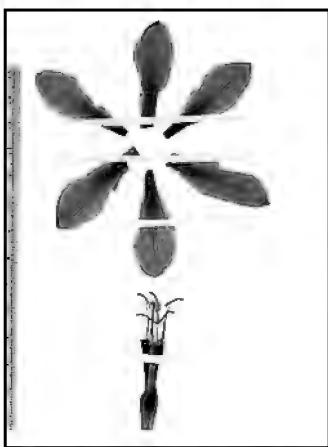


Fig. 11.
Habranthus howardii (H.P. Traub 902, MO).

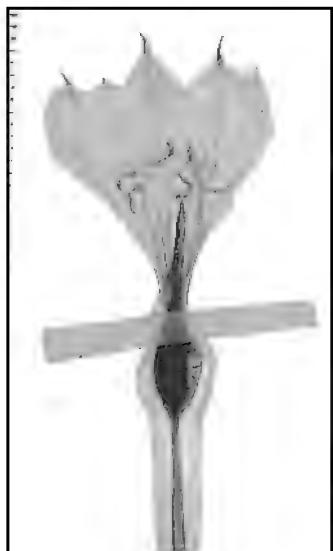


Fig. 12.
Habranthus longifolius approaching maturity (B.H. Warnock W89, TEX).



Fig. 13.
Habranthus longifolius (F.E. Lloyd 130, MO).

THE BULBS OF MT HERMON – A MEETING OF THE MEDITERRANEAN AND ARID MOUNTAIN FLORAS

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INTRODUCTION

Mt Hermon is located at the border crossing of Syria, Lebanon and Israel. It is a long mountain ridge, a disjunctive continuation of the Anti-Lebanon Mountains. It is mainly limy, reaching an altitude of 2814 m. The mountain is affected by Mediterranean climate from the west and by continental arid and cold climate from the east. A meeting point of the Mediterranean and Irano-Turanian phyto-geographic regions, it is rich in geophytes which comprise more than 10% of the total flora, a total of more than 100 species (Fragman et al, 1999). Some are species occurring throughout the Levant, some are endemic to Lebanon and Syria, and others are widespread Mediterranean ones.

Large amounts of rain and snow fall during winter on Mt Hermon, and the slopes are covered by snow above 1600 m for 3-4 months, longer at higher altitudes. Snow melts usually during April, after which rains are rare. Soil becomes wet for a short period during snow melting and then becomes dry until next autumn. The very dry summers characterize Mt Hermon (and other mountains in the Middle East) from the North Turkish – Caucasian and European mountain ranges that receive summer rainfall (Shmida & Livne, 1980). So actually the rocky slopes of higher Mt Hermon are really arid, sometimes almost desert-like.

This paper summarizes observations on the bulbous plants of the mountain during the last 25 years during excursions that took place in the southern part of the mountain. It is not a review of the whole geophytic flora. I chose to include the least known species, not the common, well known, Mediterranean ones, mostly species that occur in higher altitudes, some of which are never or rarely pictured in publications. Besides the obvious geophytic Liliales, some cormous dicotyledons such as *Aristolochia*, *Scorzonera* and *Ferula*, are also included.

The vegetation of Mt Hermon is divided into three belts (Shmida & Livne, 1980):

1. Mediterranean vegetation that is composed of open park forest, dominated by *Quercus ithaburensis* and *Ziziphus spina-christi*, altitudes 300-600 m; and Mediterranean evergreen scrub, dominated by *Quercus calliprinos*, altitude 600-1350 m. Accompanied by many other trees such as *Pistacia palaestina*, *Pyrus syriaca* and more; as well as ancient and young olive groves.
2. Open, mountain, arid, deciduous forest, dominated by *Quercus boissieri*, altitude 1350-1800 m. Accompanied by *Quercus look* and several Rosaceae such as *Sorbus torminalis*, *Prunus ursinus* (wild plum), *Amygdalus korschinskii* (wild almond), *Crataegus siniaca* and *Crataegus aaronis*. This forest has rich herbaceous flora of perennials, geophytes and annuals.
3. Tragacanth vegetation, dominated by spiny cushion-like shrublets such as *Acantholimon libanoticum*, *Onobrychis comuta* and *Astragalus* spp. as well as *Cerasus prostrata* (creeping cherry), *Zizophora clinopodiooides* and many more perennials, altitudes above 1800 m.

The absence of annuals is prominent in this belt.

The basic knowledge on the region's bulbs is based upon several floras – Mouterde's Flora of Syria and Lebanon (Mouterde, 1978), Flora Palaestina (Feinbrun, 1986) and newer publications such as the Illustrated Flora of Lebanon (Tohmé & Tohmé, 2007). Additional information was gathered in the field during private botanical excursions and others organized by "Rotem" – Israel Plant Information Centre, the Society for the Protection of Nature in Israel, Israel Nature and Parks Authority, and the Jerusalem Botanical Gardens.

Bulbs bloom throughout the year at Mt Hermon, but two prominent blooming peaks occur: March-June (Alliums in July-August as well) and October-November. The winter is snowy and poor in flower, as well as summer which is very dry.

BULBS ARRANGED ALPHABETICALLY BY GENUS:

***Allium* (Alliaceae)**

The genus *Allium* is well represented in the flora of Mt Hermon. *Allium libani* is a beautiful, almost stemless species of sunny rocky slopes of the tragacanth vegetation zone, above 1800 m. It has white-greyish dense

flowers (blooming in late May-June) and usually two broad, spreading leaves. *Allium sannineum* is a tiny least known species with pinkish-violet flowers, growing in dolines above 1900 m, and blooming in July. *Allium rupicola* is another small pink-flowered species of the same habitat and blooming season. *Allium feinbergii* is a shy but charming species, having pitcher-like purplish flowers, blooming in June above 1800 m, and often occurring and protected in spiny shrublets. *Allium carmeli* var. *roseum* is a tall, impressive, pink flowered species found in open deciduous forests and other sunny habitats in altitudes of 700-1600 m. *Allium trachycoleum* has compact, white flowering heads and scabrid leaves; it is a rare least known plant of the tragacanth vegetation belt above 1650 m. A similar, much commoner, but purple flowered species is *A. scorodoprasum*. *Allium ampeloprasum* is another common, very tall Mediterranean species in Mt Hermon occurring up to 1700 m. *Allium albotunicatum* and *A. pseudostamineum* have both straw coloured flowers and unequal pedicels; they are both common species, blooming in June-July; the first has dark bulb tunics and a more compact flowering head, and it is one of the few endemics of Mt Hermon (Ferguson et al. 1977). A similar Mediterranean species is *A. stamineum* that occurs commonly in rocky, sunny places up to 1350 m. (Fig. 1-7)

***Aristolochia* (Aristolochiaceae)**

Four common species occur in Mt Hermon. *Aristolochia parvifolia* grows sporadically in sunny rocky slopes within the Mediterranean zone below 1300 m; its tubular flower ends in an erect narrow ear. *Aristolochia sempervirens* is a small climber with yellow, purple edged flowers, ending in a roundish ear; it occurs rarely up to 1800 m. *Aristolochia scabridula* and *A. paecilantha* are similar multi-stemmed species of the open deciduous forest, occurring in altitudes of 1400-1800 m and blooming in May. The first is commoner, least known, with darker flowers and shiny darkish leaves; the second has greener flowers, light green leaves and felted young leaves and young stems. (Fig. 8-11)

***Arum rupicola* (Araceae)**

A common tuberous plant, occurring commonly above 1400 m in open deciduous forests as well in tragacanth vegetation. The spathe is narrow and long, with either dark or bright spadix. In Mt Hermon, many of the



Fig. 1. *Allium albotunicatum*, Mt Hermon, 1900 m, 19 July 2007.



Fig. 2. *Allium feinbergii*, Mt Hermon, 2000 m, 20 June 2008.



Fig. 3. *Allium libani*, Mt Hermon, 2200 m, 24 May 2007.



Fig. 4. *Allium pseudostamineum*, Mt Hermon, 1600 m, 22 June 2007.



Fig. 5. *Allium rupicola*, Mt Hermon, doline 2000 m, 21 July 2008.



Fig. 6. *Allium sannineum*, Mt Hermon, Bol'an Valley 2000 m, 29 July 2009.



Fig. 7. *Allium trachycoleum*, Mt Hermon, 2000 m, 21 July 2008.



Fig. 8. *Aristolochia paecilantha*, North Golan Heights, Mas'ade Forest 1150 m, 1 May 2008.



Fig. 9. *Aristolochia parvifolia*, Mt Hermon, above Majdal Shams 1250 m, 30 April 2008.



Fig. 10. *Aristolochia scabridula*, Mt Hermon, 1650 m, 17 May 2004.



Fig. 11. *Aristolochia sempervirens*, Mt Hermon, 1800 m, 21 June 2007.



Fig. 12. *Arum rupicola*, Mt Hermon, Bol'an Valley slope, 2000 m, 24 May 2007.

scapes are broken for some reason, perhaps consumed by boars or just broken by them. Blooming takes place in May-June. (Fig. 12)

***Asphodeline* (Asphodelaceae)**

Asphodeline brevicaulis is a rare species that occurs in sunny, dry, stony hilltops or in screes at altitudes of 1000-1600 m. It has a leafy stem that branches on the upper part. Flower buds are orange; flowers are yellow, zygomorphic, opening only in the afternoon. Anthers and styles are pending. The non-branching *A. lutea* occurs in lower altitudes within the Mediterranean zone. (Fig. 13)

***Bellevalia hermonis* (Hyacinthaceae)**

A distinct bulb, with tubular yellowish flowers that bloom in mid May-June. The large capsules open and expose unique bluish seeds. *Bellevalia hermonis* is common above 1800 m in rocky-sunny slopes, sprouting and blooming just after snow melts together with several other bulbs. (Fig. 14-15)

***Bongardia chrysogonum* (Berberidaceae)**

This peculiar plant has a deep corm, producing several leaves and a branched flowering stem. The typical pinnate, purple dotted leaves arise erect from the ground in different spots around the stem. Flowers are starry and fruits are inflated, papery and red. *Bongardia chrysogonum* occurs rarely in deep soils in altitudes 1200-1500 m. (Fig. 16)

***Colchicum* (Colchicaceae)**

Colchicum antilibanoticum is an autumnal white (rarely pinkish) flowered species with black anthers that turn yellow after pollen is spread. Several hairless leaves occur after blooming. It is commonly found in rocky slopes above 1400 m. In lower altitudes the common species is *C. troodi*, occurring in shady scrub edges, and the similar *C. hierosolymitanum* occurring in sunny places. *Colchicum feinbruniae* is a rare endemic, occurring only in Govta Canyon. *Colchicum brachyphyllum* is another rare species occurring in valleys and spring edges; it blooms with its leaves and is commonly found only in Man Valley, altitude 1450 m. (Fig. 17-18)

***Corydalis* (Fumariaceae)**

Two *Corydalis* species occur in Mt Hermon. *Corydalis erdelii* is a tiny



Fig. 13. *Asphodeline brevicaulis*, Jerusalem Botanical Gardens, 13 April 2004.



Fig. 14. *Bellevalia hermonis*, Mt Hermon, Duvdevan dolines, 2150 m, 15 May 2008.



Fig. 15. *Bellevalia hermonis*, Mt Hermon, 1900 m, 19 July 2007.



Fig. 16. *Bongardia chrysogonum*, Mt Hermon, edge of Man Valley 1450 m, 19 April 2005.



Fig. 17. *Colchicum antilibanoticum*, Mt Hermon, 2000 m, 30 October 2008.



Fig. 18. *Colchicum brachyphyllum*, Mt Hermon, Man Valley 1400 m, 30 October 2008.

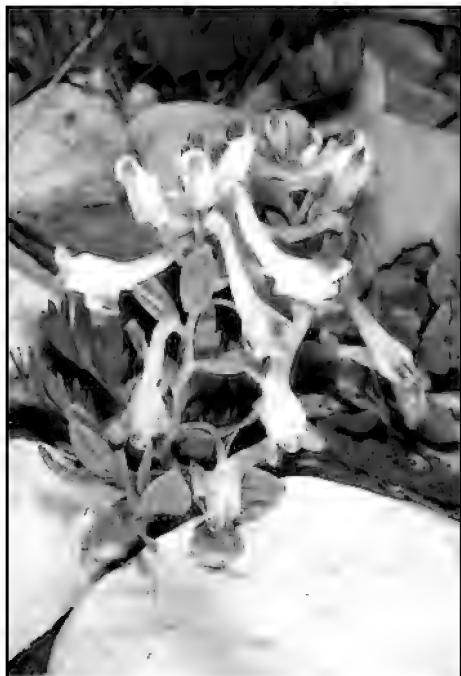


Fig. 19. *Corydalis erdelii*, Mt Hermon, Duvdevan dolines, 2150 m, 15 May 2008.



Fig. 20. *Corydalis triternata*, North Golan, Mas'ade Forest, 1100 m, 24 March 2008.

plant, locally common above 1800 m in areas, blooming where snow just melted; it has fleshy leaves, blooming in May-June. *Corydalis triternata* is a taller plant that grows sporadically in semi-shaded places within the open forests, altitudes 1300-1800 m, blooming in late April-May. (Fig. 19-20)

***Crocus* (Iridaceae)**

Crocus hermoneus ssp. *hermoneus* is commonly found in deciduous forests and tragacanth vegetation above 1400 m; it has delicate violet flowers and much branched styles. *Crocus pallasii* is even commoner; it has similar flowers but with a style that has only three branches. *Crocus ochroleucus* has white flowers with a yellow throat; it is typical to wet valleys where it grows in large numbers. *Crocus aleppicus* is rare in Mt Hermon; it has white flowers, purple veined on the outside. Most crocuses will bloom in October, together with colchicums. (Fig. 21-22)

***Cyclamen* (Primulaceae)**

Cyclamen coum is a rather rare species in Mt Hermon, occurring up to 1800 m in the shade of rocks and trees; its small purple flowers bloom in March and in lower altitudes in February. *Cyclamen persicum* is a very common Mediterranean plant that has lighter, larger flowers, occurring up to 1200 m. (Fig. 23)

***Eremurus spectabilis* (Asphodelaceae)**

This is the westernmost *Eremurus* species in the world (Ferguson et al. 1977). It bears only basal leaves and a tall scape that blooms during May-early June. The orange anthers color the whole scape. Fruit are wrinkled, globose capsules. It is common on sunny rocky slopes mainly above 1800 m, rarely occurring down to 1500 m. In some places it is dominant forming dense “forests” of scapes. (Fig. 24)

***Ferula biverticillata* (Apiaceae)**

This is one of the surprising species that was missed for many years since it blooms without leaves in summer during July-August, when there are few other plants in bloom and very few botanical excursions. In the past few years we found it to be rather common in altitudes 1500-1800 m. Foliage occurs much earlier and dries quickly. The plant has an elongated huge corm and a waxy, often reddish, much branched stem with numerous tiny

yellow flowers. It is a tumble weed, dispersing its seeds during September–October. (Fig. 25)

***Fritillaria* (Liliaceae)**

Fritillaria hermonis is quite common in rocky slopes above 1400 m. It grows in small stands within open deciduous forests and tragacanth vegetation. The scape is erect, usually one flowered, sometimes two or three flowered. Blooming takes place in April–May. Fruiting scape is ascending or pending, capsules globose. Below 1200 m, in semi-shaded places within the Mediterranean zone, one can find the taller, green flowered *F. persica*. (Fig. 26)

***Gagea* (Liliaceae)**

Gagea libanotica (syn. *Lloydia rubroviridis*) is a tiny charming little bulb, commonly found above 1800 m, within rocks in semi-shaded situations. The stem branches and bears a few white-pinkish flowers. Perianth segments are white, yellow based inside, turning purplish later, remaining papery long after the flower wilts. There are other yellow-flowered *Gagea* species in the region; the commonest is *G. villosa* var. *hermonis*. They all bloom in the snow melting zone. (Fig. 27–28)

***Geranium libanoticum* (Geraniaceae)**

This tuberous species has rounded dissected, basal leaves and typical two small stem leaves below the flowers. It is very close and probably identical to the commoner *G. tuberosum*. (Fig. 29)

***Hyacinthus orientalis* (Hyacinthaceae)**

A delicate bulb, blooming in March. It is very common in rocky slopes of the open deciduous forests in altitudes 1300–1700 m. Locally it is uniform, varying only in bulb and plant sizes. The flowers are delicately scented. The fruiting scape is pending, rather similar to *Fritillaria hermonis*, but distinguished in elongated (not globose) capsules. (Fig. 30)

***Iris bismarckiana* and *Iris westii*, *Oncocyclus* Irises (Iridaceae)**

For the past 35 years the identity of *Oncocyclus* Irises in Mt Hermon and its adjacent areas had confused botanists. All these local irises belong to the Nazareana group, characterized by bi-colored, huge flowers with dark heavily spotted/stripped falls and much paler standards. The populations



Fig. 21. *Crocus hermoneus* ssp. *hermoneus*, Mt Hermon, Man Valley slopes 1450 m, 30 October 2008.



Fig. 22. *Crocus pallasii*, Mt Hermon, Man Valley slopes 1450 m, 30 October 2008.



Fig. 23. *Cyclamen coum*, North Golan Heights, Mas'ade Forest 1100 m, 17 February 2006.

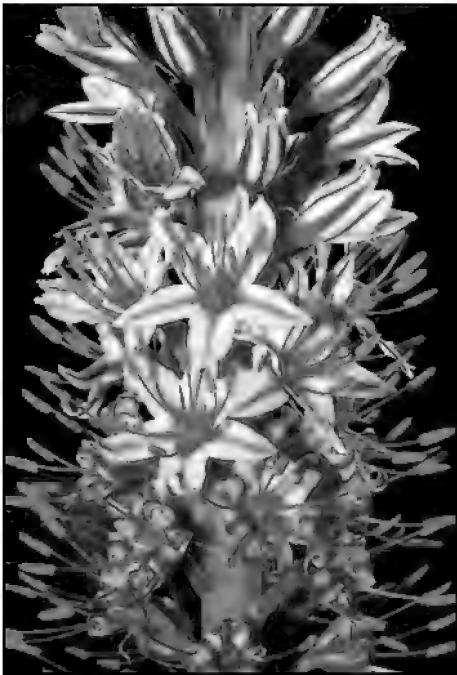


Fig. 24. *Eremurus spectabilis*, Mt Hermon 1550 m, 19 April 2005.



Fig. 25. *Ferula biverticillata*, Mt Hermon 1650 m, 28 July 2008.



Fig. 26. *Fritillaria hermonis*, Mt Hermon, Man Valley slopes 1450 m, 19 April 2008.



Fig. 27. *Gagea libanotica*, Mt Hermon, 1800 m, 21 May 2009.



Fig. 28. *Gagea villosa* var. *hermonis*, Mt Hermon, Bol'an Valley slope 2000 m, 24 May 2007.

occurring around the village of Majdal Shams (altitude 1150-1250 m) were identified as *I. bismarckiana*, a species with long stolons that produces large carpets. The leaves are lightly falcate, blunt; and there are low flowering rates and low fruitset, traits that deter horticulturists from using it in ornamental hybrids (Shahak, pers. comm.) *Iris hermona* is very similar in flower traits, but has small, flower-rich clumps, no stolons and tall scapes; its populations are known from mainly the central and eastern Golan Heights. For years some of the higher Mt Hermon populations were mistakenly treated as *I. hermona*. In 2006 we returned to iris populations that were known in leaf by Micha Livne in altitude of 2020 m. That was the first time we saw them bloom. Superficially they looked like *I. bismarckiana*, but their deeply falcata leaves, no stolons, and different flower hues made Dr. Michael Avishai from the Jerusalem Botanical Gardens identify them as the Lebanese *I. westii*. Actually this population is morphologically in between *I. westii* and the Syrian *I. damascena*. (Fig. 31, 34)

***Iris histrio* (Iridaceae)**

A beautiful iris with blue-dotted flowers, blooming in March up to 1700 m. It has typical square leaves (in cross section), ending in a whitish scale. Fruits are stalkless, occurring in April on the ground between the leaves. *Iris histrio* blooms together with *Cyclamen coum* just as temperatures rise in early spring , at times when there are only few other flowers, mainly tiny annuals, such as *Viola modesta*. (Fig. 32)

***Iris mesopotamica* (Iridaceae)**

A tall impressive, rhizomatous species, related to the cultivated *I. germanica*. It is used as an ornamental in cemeteries of the region and was not known from the wild. In Mt Hermon there are several wild populations mainly in open deciduous forests, altitudes 1300-1750 m. It was misidentified as *I. pallida* in the past (Ferguson et al. , 11977). It has short, sword-like leaves and tall branching scapes, bearing several huge violet flowers. Blooming takes place in mid May-June. (Fig. 33)

***Ixiolirion tataricum* (Ixioliriaceae)**

A cormous plant that is common throughout mountainous Middle East and eastwards to Central Asia. In Mt Hermon it is common above 1200 m, occurring on rocky dry slopes, blooming in May-June. It is hard to identify

before blooming due to its grass-like foliage. After blooming, elongate capsules develop; they include many black seeds,

***Lactuca tuberosa* (Asteraceae)**

An erect, cormous plant. The stout stem branches of the upper part, bearing large yellowish flowering heads. The plant occurs in the lower Mediterranean areas of Mt Hermon. Flowering heads open in early morning and will remain open only in cloudy days. Interestingly, in the rest of Israel, a pale blue-violet variant replaces this yellow one. (Fig. 35)

***Ornithogalum* (Hyacinthaceae)**

Ornithogalum lanceolatum is a compact species occurring in grassy places. It blooms in January-March according to altitude. It has a typical compact inflorescence that is dense in a leaf rosette. A peculiar, narrow leafed *Ornithogalum* was found recently on the slopes of Mann Valley, 1450 m; it is still not identified. In the lower Mediterranean parts of the mountain one can find the erect-cylindrical *O. narbonensis* as well as the *O. umbellatum* that is characterized by a white leaf mid-vein.

***Romulea* (Iridaceae)**

Romulea nivalis is a small plant that blooms in dolines (small valleys) in wet zones at the edge of melting snow, above 1600 m. It is very similar to the Mediterranean *R. bulbocodium* and included in it by some botanists (Ferguson et al. 1977). *Romulea nivalis* blooms typically with yellow flowered *Gagea* species such as *G. villosa* and others. (Fig. 36). In 1000-1100 m. a peculiar small flowered *Romulea* occurs that it washas been identified in the past as *R. columnae*, but its colourful flowers and habit are different; further research will reveal whether this is a new species.

***Scilla* (Hyacinthaceae)**

Scilla libanotica is a charming pale flowered species, occurring in cliffs and rocky slopes above 1500 m. The flowers are starry, whitish. It is one of the least known species, related to *S. cilicica* that grows in the Galilee in lower altitudes and has bluer flowers. It is still not clear whether these populations are really identical to *S. libanotica* from the Lebanon Mountains. In the lower Mediterranean zone (up to 1350 m) one can find the common *S. hyacinthoides*, a tall, many flowered plant and the tiny



Fig. 29. *Geranium libanoticum*, Mt Hermon 1900 m, 26 May 2009.



Fig. 30. *Hyacinthus orientalis*, Mt Hermon 1600 m, 24 March 2008.



Fig. 31. *Iris bismarckiana*, Mt Hermon, Magdal Shams 1250 m, 3 April 2000.



Fig. 32. *Iris histrio*, Jerusalem Botanical Gardens, 4 February 2009.



Fig. 33. *Iris mesopotamica*, Mt Hermon, above Neve Ativ 1300 m, 20 May 1992.



Fig. 34. *Iris westii*, Mt Hermon, lower Duvdevan Ridge 2020 m, 22 May 2006.



Fig. 35. *Lactuca tuberosa*, Mt Hermon, above Majdal Shams 1250 m, 1 May 2008.



Fig. 36. *Romulea nivalis*, Mt Hermon, Dudevan Ridge dolines 2100 m, 22 May 2006.

autumnal *S. autumnalis*. (Fig. 37)

***Scorzonera* (Asteraceae)**

A tuberous genus of the Asteraceae family. Three species are common in Mt Hermon. *Scorzonera subintegra* has pinnately lobed leaves, yellow flowers and flowering head bracts that each end in a short spreading edge. This species grows mainly in the open forests, altitudes 1300-1700 m. *Scorzonera mollis* has also yellow flowers, but non-spreading bracts and linear leaves. It also grows in the same altitudes, but penetrates also the higher tragacanth vegetation belt. *Scorzonera multiscapa* is common throughout the mountain; it has pink-violet flowers and leafless or almost leafless scapes. All species bloom in May-June. (Fig. 38-39)

***Sternbergia* (Amaryllidaceae)**

Sternbergia clusiana has impressive flowers in October. It is a bulbous plant, forming often small clumps. Population sizes range from hundreds to dozens. It grows up to 2200 m in sunny rocky slopes. The highest population known occurs in a wind-swept, very dry slope that is frozen for months every winter. Lower populations are found in more protected places. The climate range of this species is extraordinary, considering that it grows also southwards in Israel, down to the Negev Desert. The flowers are hysteranthous, and the twisted leaves and fruits develop later in winter or in spring in snowy places. *Sternbergia colchiciflora* is a tiny flower that is found in Mt Hermon rarely in 1000-1200 m. It is sub-hysteranthous.

***Tulipa* (Liliaceae)**

Tulips are rather common in the sunny slopes of Mt Hermon. There are two distinct species: the red flowered *T. agenensis* and the pink flowered *T. lownei*. *Tulipa agenensis* is variable, occurring throughout the mountain, blooming in April-May according to altitudes. Some plants resemble the desert *T. systola* in undulate leaves and/or absence of a yellow stripe in the inner side of perianth segments. Above 1800 m, one can enjoy the delicate *T. lownei*, blooming in May. It grows within the tragacanth vegetation. Surprisingly the flowers open only in the afternoon, only in sunny days. *Tulipa lownei* belongs to a group of geophytes that bloom just after the snow melts. The best chance to see it is to search about 10 m away from snow patches in areas where the soil is just drying. (Fig. 40)



Fig. 37. *Scilla libanotica*, Mt Hermon 1600 m, 24 March 2008.



Fig. 38. *Scorzonera mollis*, Mt Hermon 1800 m, 21 May 2009.



Fig. 39. *Scorzonera multiscapa*, Mt Hermon 1600 m, 26 May 2009.



Fig. 40. *Tulipa Iownei*, Mt Hermon, Duvdevan Doline slope 2100 m, 24 May 2007.

CONCLUSIONS

This selection of geophytes is only a fraction of the rich flora of Mt Hermon. Additional surveys and research are needed in the whole mountain ridge in order to obtain fuller knowledge on its flora.

Consequently, new species and new systematic treatments will certainly be published. Although local, endemic species are of special interest, widespread ones show local variation and adaptations in Mt Hermon and other localities. Ecologically and morphologically widespread species are interesting, since some occur along a wide altitudinal-climatic gradient and show the plant's adaptations in different conditions. Other interesting research options are to investigate vicariant species in different altitudes or in different mountain ridges.

The geophytic flora of Mt Hermon consists of some promising plants for cultivation as potted plants, garden ornamentals and even cut flowers. They are of special interest since many are adapted to semi-arid conditions and can be cultivated in sustained conditions and waterwise agriculture that is developing these days in many parts of the world.

All photographs by the author.

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NOTES ON THE GENUS *TULBAGHIA*: THE TAXONOMIC STATUS AND DISTRIBUTION OF *T. LUDWIGIANA* HARVEY AND *T. CERNUA* AVE'-LALLEMANT: THEIR RECIPROCAL RELATIONSHIP AND ENVIRONMENTAL ADAPTATION

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ABSTRACT

Two species of the genus *Tulbaghia* (Alliaceae), *T. ludwigiana* Harvey and *T. cernua* Avé-Lallemant are synpatric and morphologically and cytologically very strictly related. Careful analysis and study of all available evidence, including extensive field work over many years, have established the taxonomic validity of the two species, but at the same time, have led to the hypothesis that *T. ludwigiana* might be a recurrent diploid mutant form of *T. cernua* pre-adapted to a special type of extreme habitat.

Key words: Alliaceae, classification, environmental adaptation, genus *Tulbaghia*.

INTRODUCTION

Caryological investigations and field work as well as morphological studies and observations on living plants and herbarium specimens have established that *T. ludwigiana* Harv. and *T. cernua* Avé-Lall. are strictly related (Vosa 1975, 1981, 2000). The only significant differences between the two species are in their leaf morphologies and in their very diverse habitats. In both diploid and tetraploid forms of *T. cernua*, the leaves are numerous, long (from about 20 to 30 cm), narrow (from about 1 to 1.5 cm wide) and are very strongly keeled with a v-shaped section (Table 1; Fig. 5). In the tall grass veldt and grassed koppies where they grow, non-flowering plants of *T. cernua* could be easily mistaken for species of the genus *Kniphofia* (Asphodelaceae).

In contrast, the leaves of *T. ludwigiana* are relatively few in number,



Fig. 1. Inflorescence of *Tulbaghia ludwigiana* Harv. (C. G. Vosa 398) from Vosa 2000.



Fig. 2. Inflorescence of *Tulbaghia cernua* Avé-Lall. (C. G. Vosa 392) from Vosa 2000.



Fig. 3. *Tulbaghia ludwigiana* Harv., photographic reproduction of the iconotype, Plate n° 3547 in Curtis's Botanical Magazine 64, 1837.

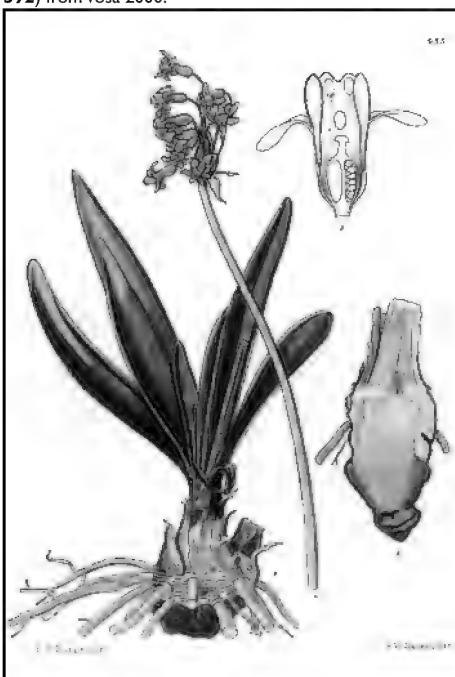


Fig. 4. *Tulbaghia ludwigiana* Harv., photographic reproduction of Plate n° 945 in Flowering Plants of South Africa 24, 1944.

relatively short (from about 10 to 15/20 cm long), somewhat lorate, much wider (from 2 cm to 2.5 cm or more in robust specimens) and have a scarcely evident keel (Table 1; Fig. 3). Furthermore, they are more or less distichously arranged and lie flat on the usually heavily grazed ground where the plants grow.

Tulbaghia ludwigiana has been found so far to be exclusively diploid while *T. cernua* occurs both as diploid and tetraploid forms differing only in overall size (Vosa 1975, 1981, 2000).

The morphology of the flower and of the corona is the same in both species (Fig. 1 & 2). In the two species, individual plants, even in the same population, may have the corona either bright yellow or orange, purplish-red or even brownish.

The following account is based on extensive field work over many years and on the examination and study of specimens in the following Herbaria: GRA, K, KZN, LE, NBG, OXF and PRE. This article is intended to be an effort to clarify the often misunderstood taxonomic status of the two taxa in question and of their reciprocal relationship.

RESULTS AND DISCUSSION

The results of the caryological investigation show that the two species have the same haploid karyotype (Group 2 of Vosa 1975, 2000) and that their chromosomes respond in the same manner to linear differentiation methods such as Q- and C-banding (Vosa 1975, 2000).

The iconotypus of *T. ludwigiana* consists in the very nice and self-explanatory illustration and description by W. H. Harvey in *Curtis's Botanical Magazine*, 64: t. 3547, 1837 (Fig. 3). The specimen illustrated is said to have come from the border of Cafferland. The location is traditionally considered to be the area between and around the lower reaches of the Kei and the Great Fish Rivers in the NE of the Eastern Cape Province. Another beautiful illustration of *T. ludwigiana* is found in *Flowering Plants of South Africa*, 24: t. 935, R. A. Dyer, 1944 (Fig. 5). The

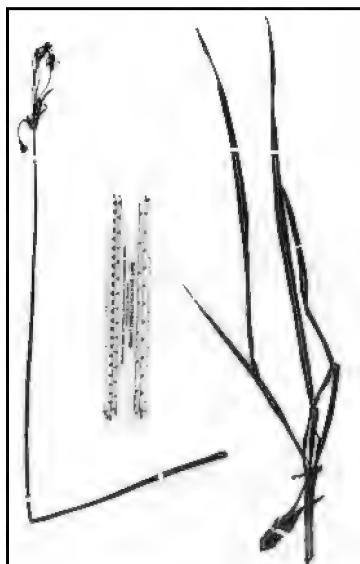


Fig. 5. *Tulbaghia cernua* Avé-Lall., photographic reproduction of the holotype (n° 73.6 in LE), by courtesy of the Curator of the Herbarium of the Komarov Botanical Institute, St. Petersburg, Russia.

plant illustrated has been found near Eshowe in Zululand, and the relative herbarium specimen (n° 27039) is in PRE(!).

The holotype of *T. cernua* Avé-Lallémant (n° 73.6, LE!; Fig. 4) is in the Herbarium of the Komarov Botanical Institute of St. Petersburg, Russia. The specimen is said to be a cultivated plant originating from the Eastern Cape Province.

Typification and lists of selected specimens seen of both species are indicated in Table 1.

The area of distribution of *T. ludwigiana* overlaps that of *T. cernua* from just NE of Port Elizabeth all through the Eastern Cape to KwaZulu-Natal, SE Mpumalanga and SW Swaziland, a remarkably extensive range of more than 1200 km in length from SW to N (see Map 1). In my opinion, careful exploration especially in the eastern macroslopes of the northern Drakensbergs may further extend the distribution range of the two species

The study of the relevant herbarium specimens and field observations has shown that *T. ludwigiana* occurs mostly as more or less isolated plants. Dyer (1944) states that plants, referable to the one he describes, have been found near Barberton (Mpumalanga), and it appears that a plant of *T. ludwigiana* has been collected at Halatikhulu, Mbabane District, Swaziland (R. H. Compton, n° 28013, PRE!).

My studies have shown that *T. cernua*, both in its diploid and tetraploid forms (Vosa 1975, 1981, 2000), occurs very often in sizeable populations within the *T. ludwigiana* distribution range where it occupies rather diverse and contrasting habitats. Thus, given the close relationship between the two species, it could be tentatively argued that the biological status of *T. ludwigiana* may be that of a recurrent diploid mutant of *T. cernua*, and that the former species may have only a transitional character closely linked to environmental adaptation.

With good reasons I can say that the possession of broad, distichously arranged leaves lying usually flat on the ground, may be an evolutionarily determinant to plants living in heavily grazed sites such as clearings in scrubland or in otherwise lightly wooded areas. In fact, practically all findings of *T. ludwigiana* have been made in this type of habitat. Hence, leaf morphology and positioning can be considered as very important evolutionary characters pre-adapting the species, as it were, at the population level, to the needs of a changing environment.

Typically, the very first findings of *T. ludwigiana* by the present author

were made in heavily grazed clearings near the mouth of the Great Fish River (Eastern Cape Province). The earliest observations were made in late August with the plants not yet in flower. Because of the grazing, the leaves appeared cut and reduced to less than half of their probable original length, and all the plants then seen were in the same condition. This is the adaptive feature of paramount importance: even when reduced to about half of their length, the leaves of *T. ludwigiana*, owing to their width, may retain enough photosynthetic activity to ensure the survival of the plant.

CONCLUSIONS

All the evidence gathered in my study leads to the conclusion that the evolutionary status of *T. ludwigiana* is most likely that of a recurrent and probably sporadic mutant entity, ready to establish itself in habitat absolutely unsuitable for its sister species *T. cernua*.

In my opinion and according to the current Code of Botanical Nomenclature, *Tulbaghia ludwigiana* Harvey and *Tulbaghia cernua* Avé-Lallemand are to be considered as valid separate species. I state this notwithstanding that the evident biological reality and their reciprocal relationship may suggest a different taxonomic ranking for the two species: DURA LEX SED LEX!

ACKNOWLEDGEMENTS

I am very grateful to Dr. Yashica Singh, Curator of the KwaZulu Herbarium, Durban, Dr. Hugh Glen and his family, and all the Staff and students of the same Herbarium, for their very valid collaboration and kindness during my stay in Durban. I wish to thank also Dr. G. Pistolesi of the Biology Department of the University of Pisa, Italy for valuable technical assistance.

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TABLE 1. *Tulbaghia ludwigiana* Harvey and *Tulbaghia cernua* Avé-Lallemant: typification and selected list of specimens.

A. *Tulbaghia ludwigiana* Harvey in Bot. Mag. 64: t. 3547, 1837:
Iconotypus (Fig. 3).

Distinguishing characters:

Habitat: heavily grazed clearings in light wooded areas from sea level to moderate altitude.

Leaves: lorate, distichous, from 2 to 2.5 cm wide with a scarcely evident keel, lying more or less flat on the ground.

Selected list of specimens seen:

Eastern Cape Province: Keiskamma, Zeyher **4267**; Kaffirdrift, Vosa **2171**; Great Fish River Mouth, Vosa **398**; West of Fraser's Camp, Barker **6993**; Cathcart, Acocks **9206**; Mill Bank, Lion's River, Moll **1209**; Kaffirdrift, Dold & Coocks **1554**; Port Alfred, Roger **s.n.**.

KwaZulu-Natal: Hlabisa, Hluhuluwe, Ward **433**; Engcobo, Marais **1036**; Eshowe, Gerstner **2263**; Hlobane, Johnstone **439**.

Swaziland: Hlatikhulu, Mbabane, Compton **28013**.

B. *Tulbaghia cernua* Avé- Lallemant, Bull. Class. Phys. Math. Acad. Petersb. 3: 202-203, 1844. Avé-Lallemant **73.6**, LE!: Holotypus (Fig. 5).
Syntypus: Drége, **s. n.**, K!.

Synonym: *T. campanulta* N. E. Br., Kew Bull. 175:136, 1901. Typus: Galpin **1660**, K!.

Distinguishing characters:

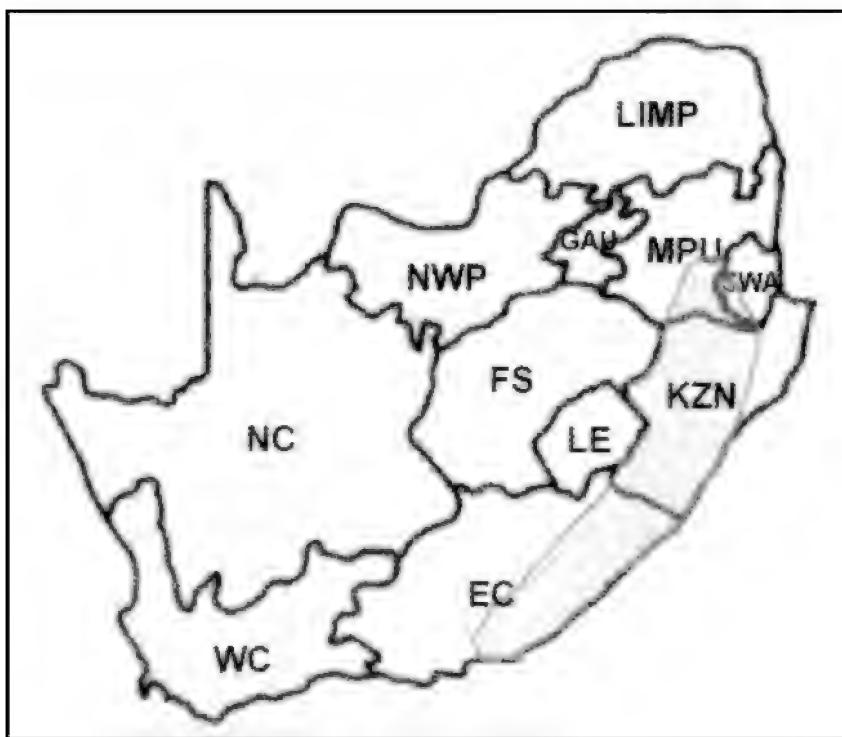
Habitat: grassed fields and koppies from sea level to moderate altitude.

Leaves: 0.5 to 1.0-1.5 cm broad, erect or slightly recumbent, usually strongly keeled.

Selected list of specimens seen:

Eastern Cape Province: Hayes Railway Sidings, Grahamstown, Vosa **392**; Gonubie Park, East London, Vosa **308**; King William's Town, Dyer **254**; Port Elizabeth, Bayliss **1567**; Port Edward, Vosa **419**; Inanda, Vosa **406**.

KwaZulu-Natal: Port Shepstone, Nicholas **2446**; Port Shepstone, High Flats, Vosa **413/32**; Flagstaff, Vosa **14**; Zwartkop, Pietermaritzburg, Foster **722**; Eastcourt, van der Merwe **264**; Crossmoor, Durban, Vosa **4432**; Central Drakensberg, Strever **1042**; Noodsberg, Williams **546**; Greytown, Wylie **s.n.**



MAP 1. The shared overall distribution area of *T. ludwigiana* and *T. cernua* (stippled). Note that the distribution range of the two species covers most of the Eastern Cape and of KwaZulu-Natal as well as some parts of Mpumalanga and Swaziland. The map shows the boundaries of the Administrative Provinces of the Republic of South Africa and of the States of Lesotho and Swaziland. (See Table 2 for the respective acronyms.)

TABLE 2. The Administrative Provinces of the Republic of South Africa and of the States of Swaziland and Lesotho and the respective acronyms. (See Map 1.)

- | | |
|------------------------|------------------------------|
| 1. Western Cape (WC) | 7. North West Province (NWP) |
| 2. Eastern Cape (EC) | 8. Gauteng (GAU) |
| 3. Northern Cape (NC) | 9. Mpumalanga (MPU) |
| 4. Free State (FS) | 10. Swaziland (SWA) |
| 5. Lesotho (LE) | 11. Limpopo (LIMP) |
| 6. KwaZulu-Natal (KZN) | |

AN UPDATED AND ILLUSTRATED TAXONOMIC SYNOPSIS OF THE GENUS *TULBAGHIA* L. (ALLIACEAE)

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In memoriam: John Bernard Bamborough, founder and first Principal of Linacre College, Oxford, eminent academic and a very dear friend.

ABSTRACT

An updated and illustrated taxonomic synopsis of the Genus *Tulbaghia* is presented and commented. Taking into account important details of floral morphology related to the corona, the genus has been *de novo* subdivided into two Subgenera namely *Eutulbaghia* and *Omentaria*. The study of the finer critical detail and structure of the corona has resulted in the grouping of the species into discrete homogeneous Sectiones within the Subgenera.

Key Words: taxonomic synopsis, Genus *Tulbaghia* L. (Alliaceae).

INTRODUCTION

In recent times, most species of the Genus *Tulbaghia* have become quite important in the indigenous folk-medicine (*Muti* or *M'thi* in a number of 'Nguni languages) in Southern Africa.

Indeed the use of *Tulbaghia* as a remedy for various illnesses was very ancient. It was in fact known that both the pastoralists *Khoi-khoi* (Hottentots) and the hunter-gathers *San* (Bushman), who were the very first inhabitants of Southern Africa, used the leaves and the roots of *Tulbaghia*, raw or in the form of infusions, to relieve headaches and to cure chest complaints. They also used the dry powdered leaves as a snuff to relieve colds. These practices were taken up in the late 17th Century by the early European settlers who used *Tulbaghia* (at the beginning probably only *T. capensis* L. and *T. alliacea* L.f. from the Western Cape) in various ways just like the present day *Khosa* and *Fingo* (*M'fenghu*) and some of the

other 'Nguni' tribes. Recently Nteso & Pretorius (2006a, b) demonstrated in vitro antimicrobial and antifungal properties of *T. violacea* Harvey extracts against plant pathogens.

The Genus *Tulbaghia* includes perhaps up to thirty species of which twenty two have been validly described and illustrated (Vosa, 1975, 2000; Vosa & Condy, 2006). Most species are found in South Africa with a particular concentration in the Eastern Cape; only a few are known to occur north of the Limpopo and Orange Rivers. The basic chromosome number of the genus is $x = 6$, and so far all species have been found to be diploid; but some, such as *T. capensis*, *T. alliacea*, *T. cernua*, *T. leucantha*, and *T. nutans* have polyploid forms often quite limited in distribution. Because of its cytology and analogous morphology, the Genus *Tulbaghia* can be regarded as vicarious of the widespread Genus *Allium*, proper of the Northern Hemisphere. The result of the recent quite strong interest, both medicinal and horticultural, in the genus is that many species are often over collected, so much so that some may be in danger of extinction in the wild. In our opinion the Genus *Tulbaghia* is in need of some measures of protection.

As a genus, *Tulbaghia* has been considered as somewhat taxonomically isolated, but the recent description (Vosa, 2007) of a new genus and species (*Prototulbaghia siebertii*) found on the Leolo Mountain Range in the Limpopo Province of South Africa, with a number of intermediate characters, is providing some clear signs of its probable evolution from a common *Allium*-like ancestor.

The following updated and illustrated synopsis of the genus, besides describing some important discriminating features, is also intended to help in the recognition of the various species. This study is the result of morphological research, carried out in cultivation and in the laboratory, and of the perusal and analysis of the available exsiccata as well as of extensive field work in Southern Africa.

The discriminatory details illustrated relate to the morphology of the *corona*, the peculiar distinguishing character of the genus, on which the Subgenera and their Sectiones, presented herein, are based.

Apart from Plate 3, all of the illustrations originate from photographs generally taken in the field, and they have been grouped in two Plates (1, 2). An additional Plate (3) details the haploid chromosome complements. The preliminary results of recent studies carried out by the author on

the ontogeny of the flower of *Tulbaghia*, show that the *corona* may derive from the fused dorsal outgrow of the staminal filaments. This indicates the correct interpretation of the morphological situation by previous authors such as Linnaeus (1771), Salisbury (1866) and Baker (1871) who considered the elements forming the *corona* as *staminodia*.

SYNOPSIS

GENUS TULBAGHIA, Linnaeus, Mant. Pl. 2:148, 1771. Non Heister, Descr. Brunsv. 10, 1753 ex Kuntze, Rev. Gen. Pl. 718, 1891 = *Agapanthus* L'Herit. Syn.: Genus *Omentaria* (s.l.): Salisb. Gen. Plant. Frag. 87, 1866.

SUBGENUS EUTULBAGHIA

Syn.: Genus *Tulbaghia* L. (s.s.), Salisb. Gen. Plant. Frag. 87, 1866; J.G. Baker in J. Linn. Soc. 11:370, 1871.

Diagnosis: Staminodia carnosa vel carnosula, in corona concreta, raro sublibera.

Chromosomatum numerus: $2n=2x=12$.

Sectio I

Staminodia carnosa, profunde emarginata, libera vel basi solam connata.

T. capensis L. (Plate 1, Figure 1)

Mant. Pl. 2:118, 223, 1771.

Type: C. Linnaeus 411.1 (Herb. Linn. !)

Sectio II

Staminodia carnosula, profunde emarginata, libera vel basi solam connata.

T. galpinii Schltr. (Plate 1, Figure 2)

J. Bot. 35:382, 1894.

Isotype: E.E. Galpin 2179 (PRE!)

Sectio III

Staminodia carnosa in corona integra plus minusve crenata.

T. alliacea L.f.

Suppl. Pl. 183, 1781.

Type: C. Linn. fil. 411.2 (Herb. Linn. !)

T. dregeana Kunth (Plate 1, Figure 3)

Enum. Pl. 4:483, 1883.

Type: J.F. Drége **2568** (K!)

T. lugwigiana Harvey (Plate 1, Figure 4)

Bot. Mag. 64: t.3547, 1837.

Iconotype: W.H. Harvey in Bot. Mag. 64: t.3547 (!)

T. acutiloba Harvey

Thes. Cap. 2:51, t.180, 1854.

Syntype: T. Cooper **463** (K!)

T. cameronii Baker

J. Bot. 16:321, 1878.

Type: V.L. Cameron **2/75** (K!)

T. cernua Avé-Lall.

Bull. Class Phys. Math. Acad. Petersb. 3:202-203, 1849.

Type: R.C.B. Avé-Lallemsnt **73.6** (LE!)

T. leucantha Baker

Fl. Cap. 6:404, 1897.

Syntype: J. Medley-Wood **1200** (K!)

T. tenuior Krause & Dinter

Bot. Jahrb. 45:141, 1910.

Type: A. Dinter **790** (B n.v.)

T. macrocarpa Vosa

Ann. Bot. (Rome) 34:84-87, 1975.

Type: C.G. Vosa **132** (OXF!)

T. nutans Vosa

Ann. Bot. (Rome) 34:82, 1975.

Type: C.G. Vosa **536/55** (OXF!)

T. transvaalensis Vosa

Ann. Bot. (Rome) 34:87, 1975.

Type: C.G. Vosa **486/49** (OXF!)

T. verdoorniae Vosa & Burbidge

Ann. Bot. (Rome) 34:102, 1975.

Type: R. Wood **161**, NUH 35321 (!)

T. coddii Vosa & Burbidge

Ann. Bot. (Rome) 34:101, 1975.

Type: L.E. Codd **6746** (PRE!)

T. pretoriensis Vosa & Condy

Caryologia 59:164-167, 2006.

Type: G. Condy **24** (PRE!)

Iconotype: Plate 2164, Fl. Pl. of Africa 57:23, 2001.

Sectio IV

Staminodia carnosa in corona integra sed parva laciniata.

T. simmieri G. Beauverd (Plate 2, Figure 1)

Bull. Herb. Boissier, sér. 2, 8:988, 1908.

Type: G. Beauverd, Herb. Boiss. **s.n.** (G!)

Sectio V

Staminodia carnosa in corona integra sed parva laciniata.

T. montana Vosa (Plate 2, Figure 2)

Ann. Bot. (Rome) 34:106, 1975.

Type: C.G. Vosa **70** (OXF!)

T. natalensis Baker

Gard. Chron. (3)9:668, 1891.

Type: J. Medley-Wood **4045** (NUH!)

Sectio VI

Staminodia carnosula in corona integra sexlobata sed brevissima.

T. rhodesica R.E. Fries (Plate 2, Figure 3)

Wiss. Ergeb. Schwed. Rhod.-Kongo Exped. (1911-1912), 1:227-228,
1937.

Type: R.E. Fries (B n.v.)

SUBGENUS *OMENTARIA* (Salisb.)

Baker in J. Linn. Soc. 11:370, 1871.

Diagnosis: Staminodia parva, ligulata, inter sese omnino libera.

Chromosomatum numerus: $2n=2x=12$.

Sectio I

Staminodia, parva, ligulata, plus minusve carnosam, inter sese omnino libera.

T. violacea Harvey (Plate 2, Figure 4)

Bot. Mag. 64: t.3555, 1837.

Iconotype: W.H. Harvey in Bot. Mag. 64: t.3555, 1837.

T. cominsii Vosa

J. S. Afr. Bot. 45:125-132, 1979.

Type: D. Comins 1718 (NUH!)

CONCLUSIONS

The results of morphological investigations carried out in Herbaria, in the field, and in cultivation have highlighted the need of subdividing the Genus *Tulbaghia* into two Subgenera, *Eutulbaghia* and *Omentaria*. This subdivision was originally suggested by Baker (1871). The epithet *Omentaria* was first used by Salisbury (1866) for the whole genus.

In order to take into account the discriminating details of floral morphology relating to the *corona* and to help in the correct identification of the species, it has been deemed useful to redefine and to extend the diagnoses and to group the relevant species into discrete Sectiones within the two Subgenera. A key in English to the Subgenera and to the Sectiones is provided in Appendix II.

ACKNOWLEDGEMENTS

I am very grateful to the many people in Southern Africa and in Europe who helped me during my research. In a special manner, I wish to thank the Curators of the various Herbaria worldwide who ever so kindly provided me with material and essential information and without whom this work could not be completed successfully. I wish to thank also Prof. Riccardo Maria Baldini of the University of Florence, Italy, for reading the manuscript and for useful discussion and comments.

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APPENDIX I

It is relevant to note that in *Tulbaghia* the karyotypes of the various species, subdivided into seven well differentiated Groups on the basis of chromosome morphology by Vosa (1975, 2000; see Plate 3), correspond only in part to the subdivisions of the genus into Sectiones based on details of floral morphology as in the present work.

For example, karyotype Group 1 includes *T. capensis* (Sectio I) and *T. alliacea* (Sectio III). However, *T. ludwigiana*, *T. cernua*, *T. dregeana*, *T. tunuior*, and *T. nutans* from Sectio III possess karyotypes of Group 2, while *T. leucantha*, *T. verdoorniae*, and *T. coddii* also of Sectio III have karyotypes belonging to Group 5. *Tulbaghia galpinii* falls into karyotype Group 5 but is classified taxonomically as Sectio II. Other karyotype Group/morphological Sectio mismatches include *T. macrocarpa*, *T. transvaalensis* and *T. pretoriensis* with karyotypes of Group 3 but in Sectio III, and also *T. violacea* and *T. cominsii* of the Subgenus *Omentaria* Sectio I with Group 2 and Group 3 karyotypes respectively. The situation of *T. simmleri* (Sectio IV, karyotype Group 2), *T. montana* (Sectio V, karyotype Group 6), and *T. natalensis* (Sectio V, karyotype Group 5) is rather interesting as these three species appear very isolated taxonomically from each other, as are the cases of *T. rhodesica* (Sectio VI, karyotype Group 7) and *T. cameroni* (Sectio III, karyotype Group 7). The latter two, together with *T. macrocarpa* seem to occur only north of the Limpopo River. The widespread *T. acutiloba* is to be considered a special case with its unique karyotype Group 4 but with a floral morphology belonging to Sectio III.

It is evident that the kind of discrepancies outlined above may be demonstrating that in the Genus *Tulbaghia*, floral morphology – aimed at efficient reproduction – and the karyotype – a special gene packing and recombining system – in many cases seem to follow independent evolutionary pathways.

APPENDIX II

Analytical key to the Subgenera and to the Sectiones of the Genus *Tulbaghia*, based upon the morphology of the *corona*.

- A. *Corona* fleshy or scarcely fleshy, entire, rim crenulated or laciniated.
B. *Corona* consisting of three ligulate lobes free to the base.

A. Subgenus *Eutulbaghia*.

1. *Corona* fleshy.

Corona deeply six-lobed *Sectio I*

Type: *T. capensis* L.

Corona with more or less crenulate rim..... *Sectio III*

Type: *T. alliacea* L.f.

Corona with laciniated rim..... *Sectio IV*

Type: *T. simmleri* G. Beauverd

2. *Corona* scarcely fleshy.

Corona deeply six-lobed..... *Sectio II*

Type: *T. galpinii* Schltr.

Corona with laciniated rim..... *Sectio V*

Type: *T. montana* Vosa

Corona formed by six very short lobes..... *Sectio VI*

Type: *T. rhodesica* R.E. Fries

B. Subgenus *Omentaria*

Corona formed by three ligulate lobes free to the base... *Sectio I*

Type: *T. violacea* Harvey



PLATE I.

- Fig. 1. (upper left) *Tulbaghia capensis* L.—The coronal lobes are very fleshy and are free nearly to the base.
Fig. 2. (upper right) *Tulbaghia galpinii* Schltr.—Note the scarcely fleshy coronal lobes free almost to the base.
Fig. 3. (lower left) *Tulbaghia dregeana* Kunth—The corona is very fleshy, annular in shape and shallowly crenate.
Fig. 4. (lower right) *Tulbaghia ludwigiana* Harvey—The corona is very fleshy, urceolate and somewhat crenate.

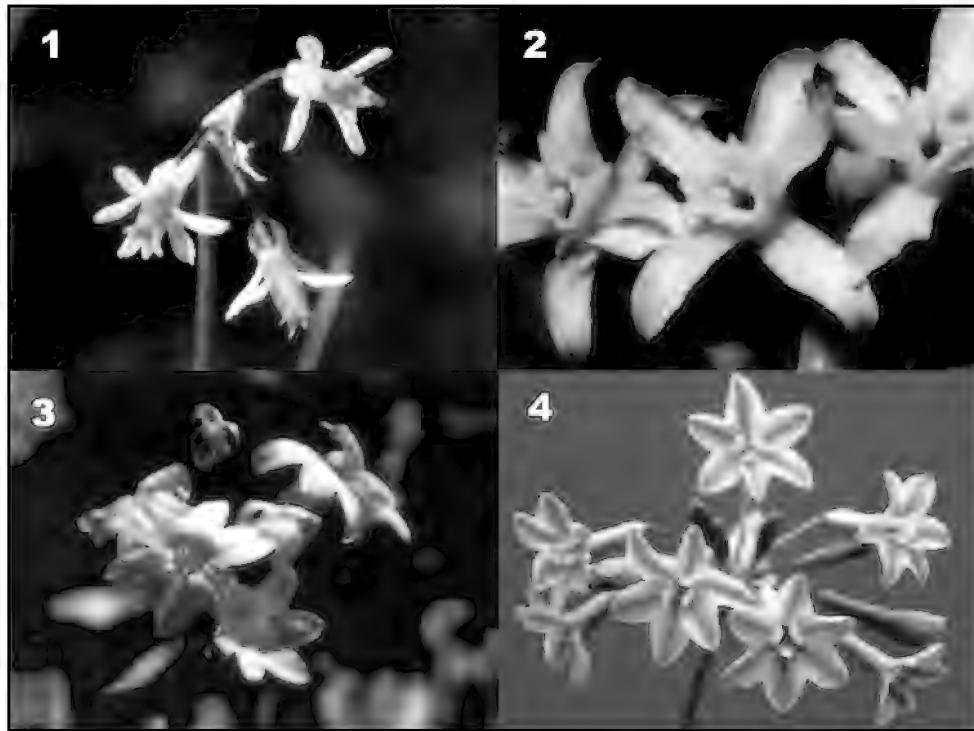


PLATE 2.

- Fig. 1. (upper left) *Tulbaghia montana* Vosa – The corona is not very fleshy and its rim is formed by acute lacinie.
Fig. 2. (upper right) *Tulbaghia simmieri* G. Beauverd – The corona is moderately fleshy and its rim appears laciniate.
Fig. 3. (lower left) *Tulbaghia rhodesica* R.E. Fries – The corona is formed by six very short lobes united just above their base.
Fig. 4. (lower right) *Tulbaghia violacea* Harvey – The three coronal lobes are ligulate, free to the base and placed at the base of the inner perianth segments.

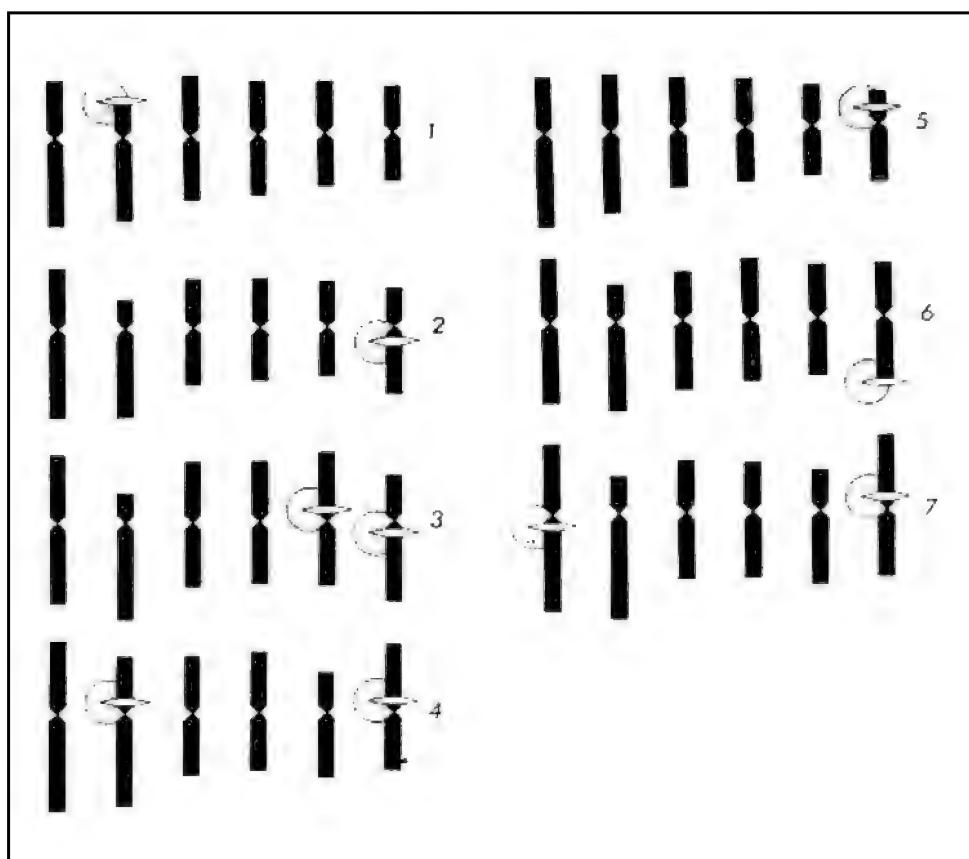


PLATE 3.

Diagrammatic representation of the seven different haploid karyotype Groups of the Genus *Tulbaghia* (from Vosa, 1975).

1. *Tulbaghia capensis* L.
2. *Tulbaghia dregeana* Kunth.
3. *Tulbaghia transvaalensis* Vosa.
4. *Tulbaghia acutiloba* Harvey.
5. *Tulbaghia coddii* Vosa & Burbidge.
6. *Tulbaghia montana* Vosa.
7. *Tulbaghia rhodesica* R.E. Fries.

Note that the main differences between the karyotypes are the position and the number of the nucleolar organizers (indicated by a stippled circle at the side of a narrow lozenge) and of the position of the centromere of the second chromosome of the complements.

SISYRINCHIUM LAETUM (IRIDACEAE): NEW STATUS FOR AN ARGENTINIAN ENDEMIC FROM PATAGONIA

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ABSTRACT

Sisyrinchium macrocarpum Hieron. subsp. *laetum* Ravenna is elevated here to full species. *Sisyrinchium macrocarpum* and *S. laetum* are both Argentine endemics. The many morphological differences between them, which justify this change of status in our judgement, are detailed. We discuss and consider the significant discovery of a nomenclatural error. This should be represented as *S. macrocarpon* Hort., an invalid synonym of *S. macrocarpum* Hieron., to avoid confusion with the illegitimate epithet *S. macrocarpon* E.P. Bicknell.

INTRODUCTION

Sixteen years ago the present authors submitted a change of status for *Sisyrinchium macrocarpum* subsp. *laetum* (Fig. 1), an element of the Patagonian steppe flora (Fig. 2), to full species, *S. laetum*, in the Alpine Garden Society's comprehensive new encyclopaedia (Watson & Flores, 1994). Our instructions to indicate this modification legitimately by including the suffix 'stat. nov.' and citation of the basionym were overlooked. *Sisyrinchium laetum* did appear in the text and as an illustration caption then, but not validly.

We next attempted legitimate publication in a major Argentinian botanical periodical. Appreciating that a rigorous peer review would be inevitable, as well as less ready acceptance of our conclusion, we carefully detailed the various morphological discontinuities and incompatible differences which had motivated our decision. This included drawing up a comparative table. Nevertheless, we ran into insuperable difficulties with numerous review comments and objections, so withdrew the paper.

The intended change has lain fallow but not forgotten since. The flora of Patagonia, which includes *S. laetum*, is enjoying a steady increase of

popular interest. Ferreyra et al. (2006) authored a field guide of some of the region's commoner Andean flora in Argentina. Regular investigative visits by informed groups from Europe now take place (J. & H. Birks, P.J. Erskine, M. & A. Sheader, in litt.). Reports of their itineraries with comprehensive identifications appear on websites. *Sisyrinchium laetum* is illustrated on one such, where identified as *S. macrocarpum* (Ecological and Environmental Change Research Group). Determinations for plants encountered during this fieldwork are largely derived from *Flora Patagonia* (Correa, 1969-1999). Although an Argentinian regional flora, its pages contain plants also found in adjacent Chile. The taxon under consideration was entered together with protologue as *S. macrocarpum* subsp. *laetum* in the first published volume of *Flora Patagonica* (Ravenna, 1969) (Fig. 1). An increasing number of images of these two taxa appear on the internet. The output of regional vascular catalogues and floras has if anything expanded as well. Such reasons make accurate relevant taxonomy of greater urgency than ever, including revision of earlier conclusions in need of updating.

TAXONOMY

***Sisyrinchium laetum* (Ravenna) J.M. Watson et A.R. Flores, stat. nov.**
Basionym: *S. macrocarpum* Hieron. subsp. *laetum* Ravenna. In Correa, N.M. (ed.), *Flora Patagonica* 2:176 (1969) (Fig. 1)

Discussion

Specific differentiation between *Sisyrinchium laetum* and *S. macrocarpum*
According to the Latin diagnosis of Ravenna (op. cit), his subsp. *laetum* differed from the type subsp. *macrocarpum* (Hieronymus, 1881) by its shorter stature and reduced size of all parts; also by the recurved pedicels of mature capsules. In his accompanying notes he additionally drew attention to its solitary spathes, patent tepals and the dense, profusely flowered mats of its growth-form.

In fact actual morphological differences exceed Ravenna's comparison considerably and critically. The following measurements of organs are taken from the type descriptions (Hieronymus, op. cit.; Ravenna, op. cit.):

- 1) Growth pattern: In cultivation at least, *S. macrocarpum* (Fig. 3) does not appear to be a particularly long-lived plant. It forms compact tufts, but of no lasting substance. By contrast *S. laetum* is a strongly rhizomatous plant which spreads into large and persistent perennial

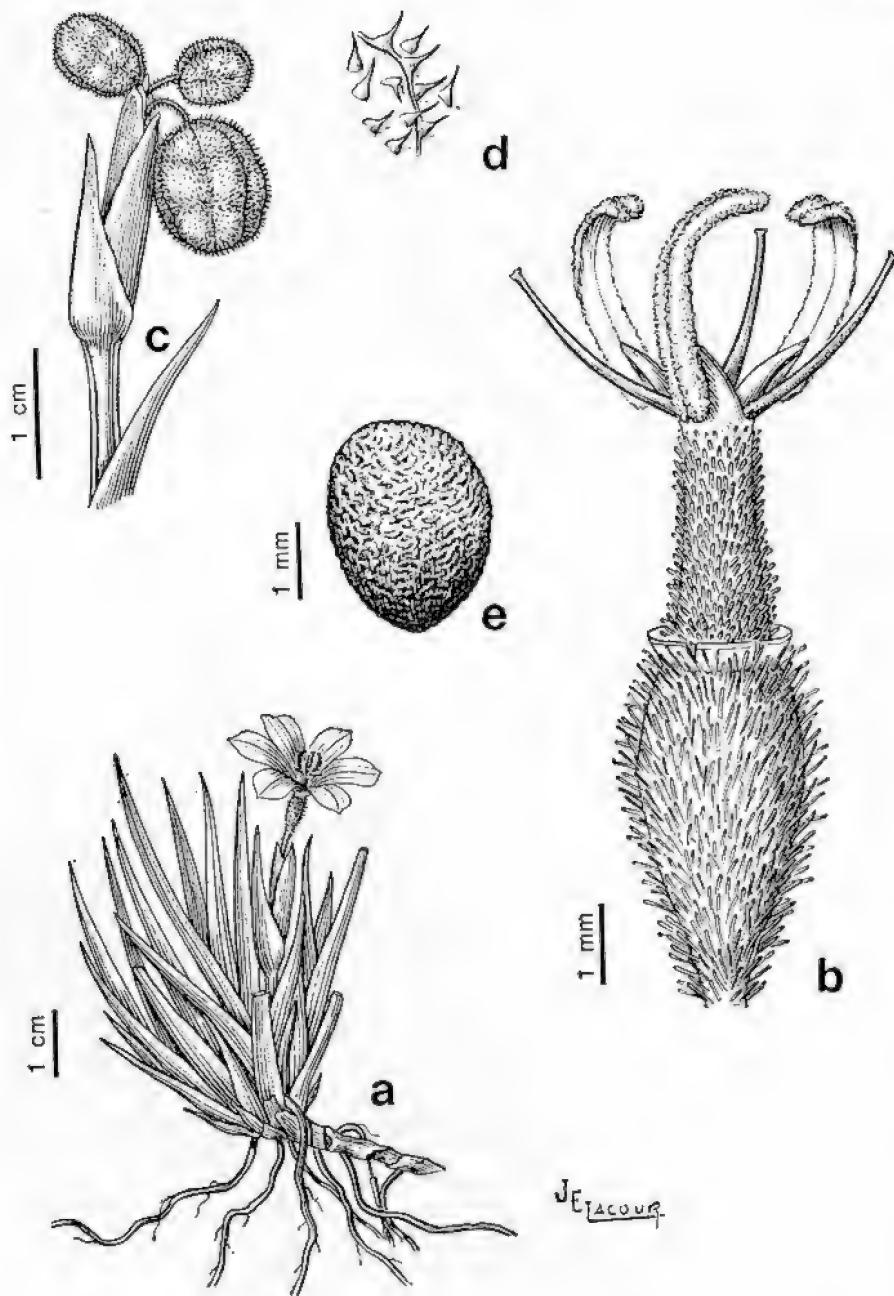


Fig. 1. *Sisyrinchium laetum*, known then as *S. macrocarpum* subsp. *laetum*. Flora Patagonia 2, 1969. Drawing by J.E. Lacour.

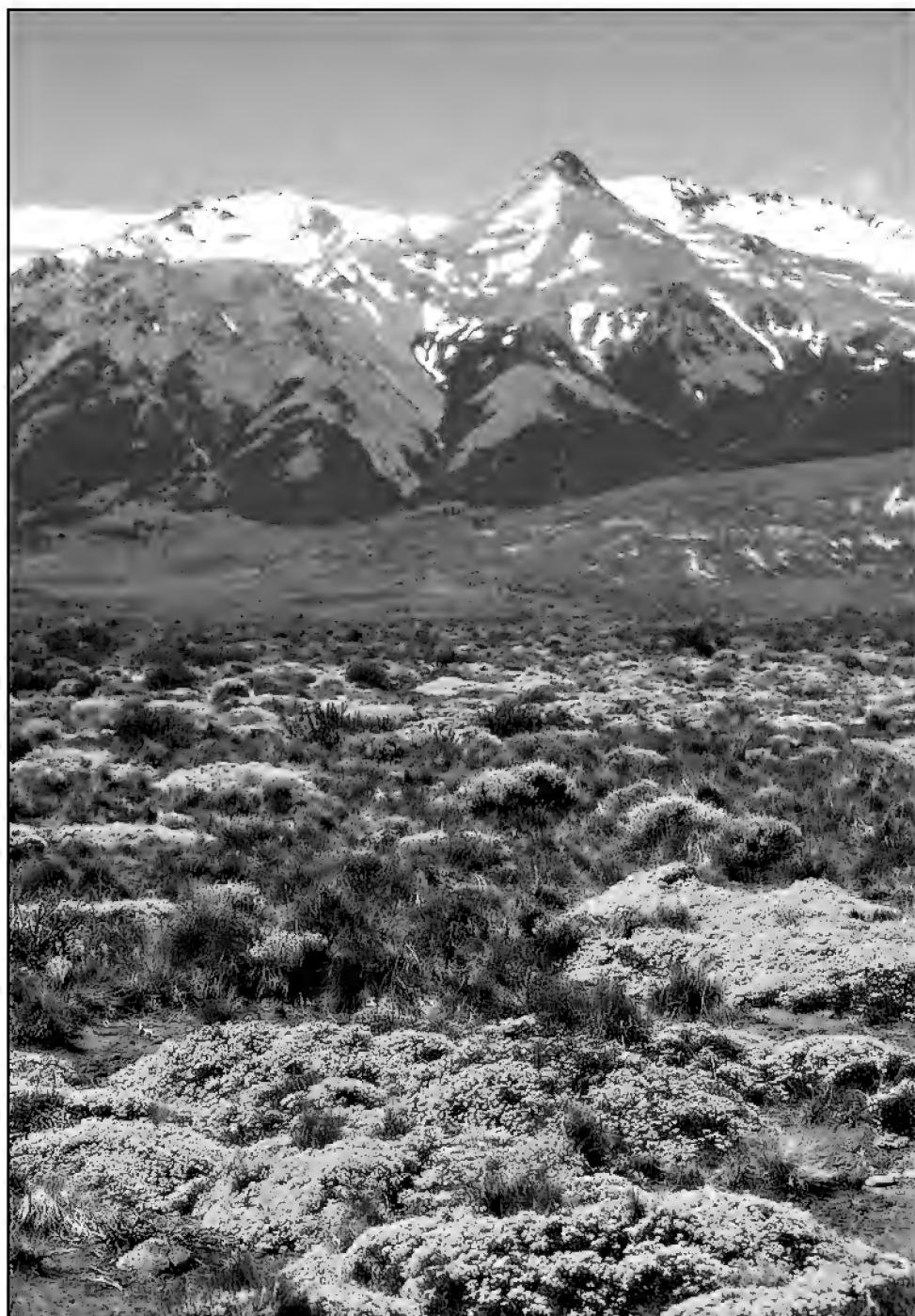


Fig. 2. The steppe habitat of *Sisyrinchium laetum* with dominant flowering junellias. Esquel, Chubut Province, Argentina, 1999.
Photograph by J.M. Watson.



Fig. 3. *Sisyrinchium macrocarpum*. Photograph by R. Heaton, 2007, with kind permission of The Plantsman.



Fig. 4. *Sisyrinchium laetum*. Glaucous-leaved form with brown basal spot. Near Esquel, Chubut Province, Argentina, 1999.
Photograph by J.M.Watson.

clumps of dense, resilient foliage over time (Fig. 4). Sometimes the centre of a very mature specimen may die out, but the perimeter continues to expand, as with some grasses; 12-15 cm is a regular diameter, and it may reach twice that or more.

2) Foliage: The leaves of *S. macrocarpum* measure 10-25 cm in length and 4-5 mm in width. They are a more or less glaucous green. Importantly, they are chartaceous, therefore somewhat fragile, and will tear or damage at any point relatively easily. They also show a characteristic tendency to blacken at the tips (pers. obs.) *Sisyrinchium laetum* laminas vary between 4-15 cm, by 1.7-2.5 mm. In reality foliage of *S. laetum* looks far less like a miniature version of *S. macrocarpum* than those figures suggest. Most significantly, leaves of the former may also be strongly glaucous, but are almost invariably darker and of a tough, fibrous, flexuose nature.

3) Inflorescence: *S. macrocarpum* produces a series of floral bracts along its scape. They flower together, each spathe with one or more often oblique-facing flowers at once (Fig. 3). *Sisyrinchium laetum* is unispathulate and usually or always produces its flowers in solitary succession and facing upwards (Fig. 4). As Ravenna (op.

cit.) pointed out, other species such as *S. arenarium* Poepp. produce ecological microforms¹ with all-round reductions (Fig. 5). These however have the appearance, the facies, of dwarf versions of the usual larger form. *Sisyrinchium laetum* does not in the least resemble a dwarf *S. macrocarpum*. Despite its exposed habitats close to the limit of vegetation (Fig. 6), the latter apparently does not vary in stature. Moreover, the spathe bracts of both differ markedly, those of *S. macrocarpum* being wide and tapering down relatively shortly compared with the narrower, more attenuated bracts of *S. laetum*. NB. There is a paper on the inflorescences of Argentinian sisyrinchiums (Sancho, 1982), which unfortunately we have been unable to access in the time available.

4) Flower: Despite the note by Ravenna (1969), as recorded above, that tepals of *S. laetum* are patent, flower shapes of the two species differ fundamentally. *Sisyrinchium macrocarpum* is saucer-shaped. That is to say the tepals spread horizontally from the base and curve up slightly at the apex (Fig. 3). The centre is not sunken. We know of one remarkable population of *S. laetum* where the predominant form is notably campanulate, with ‘tulip-shaped’ perianths (Fig. 7, 8). However, this is exceptional. As a rule in *S. laetum* tepals are almost invariably somewhat recurved towards the base and form a small depression (i.e. the base is subcampanulate) (Fig. 9, 10), as with many others in the genus. When rarely patent from the base, its tepals are downcurved at the apex, as is often typical otherwise (Fig. 4). Overall diameter is not a major taxonomic factor here, and according to type descriptions is around 2 cm for both, although we would say *S. macrocarpum* tends undoubtedly to be the larger and more substantial of the two. However, this latter effect is enhanced by their distinctly different tepal shapes. Those of *S. macrocarpum* are obovate to subobovate, clearly widened towards the perimeter of the flower, lending its best forms a very ‘full’ appearance. Those of *S. laetum* are subobovate to oblanceolate and more pointed at the apex, thus presenting a somewhat starry appearance. Its flowers are still satisfyingly integral enough, but more centrally so. Variation of perianth coloration and markings are not usually critical for the genus either, but may be in this case, and if not

¹ Some or all of these have probably now been published recently as species by Ravenna in his own non-peer reviewed and almost inaccessible pamphlet *Onira*, for example *S. chapelcoense* (Ravenna, 2006) (probably Fig. 5).

are definitely strongly indicative. *Sisyrinchium macrocarpum* is clear yellow, *S. laetum* tends to a shiny, more golden yellow. A major feature of *S. macrocarpum* is the chocolate-brown, pointed ‘arch’ mark at the base of each tepal, which forms the border of a highly characteristic, well-defined zig-zag central zone (Fig. 3, 11). This does not occur on any *S. laetum* known to ourselves, where in fact the upper surface is often unmarked (Fig. 9, 10), and the only markings are facultative small, pale brown flecks, rarely forming a very indistinct zig-zag or a larger blotch at the base of each tepal (Fig. 4, 8, 12). Similar coloured intense feathering has been observed on the reverse of the perianth (Fig. 12). This latter is not a marked feature for *S. macrocarpum*.

Sisyrinchium macrocarpum tepals are visibly veined (Fig. 3, 11), those of *C. laetum* not.

5) Capsule and ovary: Greater study is required to determine whether any aspect of the capsules other than the recurved pedicels of *S. laetum* supports our greater separation of the taxa. Available information indicates variable capsule dimensions. Surfaces for both are glabrous or with short indumentum (Ravenna, 1969; Ruiz Leal 1972; Mathew, 1977). The ovary of *S. macrocarpum* is glabrous (Hieron., op. cit.), but noted as densely covered with short yellow hairs in *S. laetum* (Ravenna, 1969) (Fig. 1). This may be a possible further discontinuous character. We have not had an opportunity to compare their seeds.

6) Ecology: The two species clearly diverge in this aspect. *Sisyrinchium macrocarpum* is an element of the mid- to high Andean flora (Hieronymus, op. cit.; Ruiz Leal, op. cit.) (Fig. 6), *S. laetum* basically a Patagonian steppe ecotype of the plains or mountains (pers. obs.) (Fig. 2). While by no means excluding an infra-specific relationship, in this case these distinct adaptations tend to reinforce the differences. According to the Argentine vascular list of Múlgara (1996), *S. macrocarpum* occurs in the Patagonian provinces of Río Negro and Chubut. It is not, however, recorded in *Flora Patagonica* (Correa, op. cit.), nor has it been found in Patagonia by the many local resident and visiting botanists and plant enthusiasts, including ourselves. We suspect this to be a case of mistaken identity from voucher specimens, and that *S. macrocarpum* and *S. laetum* are in all probability distinctly allopatric, with the latter reaching little or no further north into Mendoza than the southern boundary with the neighbouring province of Neuquén.



Fig. 5. *Sisyrinchium* aff. *arenarium* (perhaps *S. chapelcoensis* of Ravenna). Another dwarf ecotype. Cerro Chapelco, Neuquén Province, Argentina, 1991. Photograph by J.M.Watson.



Fig. 6. Looking down at the locality where Hieronymus collected the syntype of *Sisyrinchium macrocarpum*. Sierra de Famatina, 3500-4000 m, La Rioja, Argentina, 2007. Photograph by A.R. Flores.



Fig. 7. *Sisyrinchium laetum*. The 'tulip-shaped' form. Cerro Waylie, Neuquén Province, Argentina, 2002. Photograph by A.R. Flores.



Fig. 8. *Sisyrinchium laetum*. Interior of flower of 'tulip-shaped' form, showing brown blotches. Cerro Waylie, Neuquén Province, Argentina, 2002. Photograph by A.R. Flores.



Fig. 9. *Sisyrinchium laetum*. A dark-leaved form with unmarked tepal upper surfaces. Paso El Choique, S. Mendoza Province, Argentina, 1988. Photograph by J.M. Watson.



Fig. 10. *Sisyrinchium laetum*. Closeup showing central depression, unmarked upper surfaces and brown-feathered lower surface of opening bud. Paso El Choique, S. Mendoza Province, Argentina, 1988. Photograph by J.M. Watson.



Fig. 11. *Sisyrinchium macrocarpum*. Photograph by L.E. Moon, 2006, with kind permission of Scottish Rock Garden Club.



Fig. 12. *Sisyrinchium laetum*. Close up of brown-blotted flower showing subcampanulate base. Cerro Waylie, Neuquén Province, Argentina, 2002. Photograph by A.R. Flores.

Several features above are readily apparent from the accompanying illustrations.

Note: At this point we intended to profile the histories in botany and horticulture of *S. laetum* and *S. macrocarpum*. However, as there is insufficient available remaining text space in this current issue, that aspect must be deferred.

It may however be observed briefly that *S. laetum* has yet to establish in cultivation, but is reasonably well known in the wild. By contrast the situation for *S. macrocarpum* is the exact converse. While researching horticultural data for the latter species, we uncovered the following situation.

A nomenclatural error? What is meant in Britain by *Sisyrinchium macrocarpon*?

Although *S. macrocarpum* is somewhat better represented in horticultural literature, there are highly unexpected omissions, which in turn uncovered a most curious puzzle. *Sisyrinchium macrocarpum* is a fine plant. It has justly been given an Award of Merit by the British Joint Rock Garden Plant Committee (Mathew, op. cit.). To find out how widespread it is beyond the confines of specialist alpine gardening literature (e.g. Mowle, 1985; Beckett, 1994), we consulted two fairly recent Royal Horticultural Society sources, *The RHS Plant Finder*, 2003/04 edition (Philip & Lord), the most up-to-date version available to ourselves, and the major encyclopaedia (Brickell, 1996). To our surprise *S. macrocarpum* was not entered in either. However, the *Plant Finder* cited 21 nurseries which listed *S. macrocarpon*, and noted it had also received an RHS Award of Garden Merit. The encyclopaedia gave no mention of either name, despite the latter having received signal RHS recognition in 1993. We assumed this to be oversight rather than a deliberate omission.

Inevitable questions arose. What plant did the epithet *macrocarpon*, as found in RHS literature, represent? Was it an intended return from *macrocarpum* to the form of the name originally published? Was it even the same species? Or what?

In fact Hieronymus (op. cit.) did publish his species as *S. macrocarpum*, and that spelling has been followed by all subsequent Argentine authorities.

The next significant discovery was the complete absence of *S. macrocarpon* from the Alpine Garden Society's encyclopaedia (Beckett, op.

cit.) and its collective quarterly bulletins (Alpine Garden Society, 1993), a remarkable omission for an award plant recently on sale at 21 nurseries, many specialising in alpine plants!

We then referred to *The World of Iridaceae*, a popular and comprehensive monograph (Innes, 1985). This listed *S. macrocarpum* Hieron and *S. macrocarpon* E.P. Bicknell. The latter was recorded as a redundant synonym of *S. ensigerum* E.P. Bicknell, a short Texan species with blue to pale violet-blue flowers². However, a wide range of modern internet sources treat both *S. ensigerum* and *S. macrocarpon* as valid and distinct. There also appears to be conflicting information as to whether the latter's flower colour is in the blue-violet range, or yellow. Was this then the species which sported a coveted Award of Garden Merit, figured in the catalogues of 21 British nurseries, and yet had never been mentioned in expert alpine gardening circles? Surely not? As a double-check, we looked up *Sisyrinchium macrocarpon* on the website of the International Plant Names Index, centred on Kew (IPNI). Only one entry was cited, that of Bicknell.

Attempts at further elucidation were based on the internet and personal contacts. We began by looking up *S. macrocarpon* Award of Garden Merit online (Royal Horticultural Society). It was not possible to glean more information beyond the fact than an entity of that name received the award in 1993: NB – this is an active, **current** website. Searching all references to *S. macrocarpon* yielded information from U.S. sources about Bicknell's Texan plant. British horticultural sites referred to the mere name or indicated a yellow-flowered plant. The most definitive entry revealed a superb image of *S. macrocarpum* captioned 'S. macrocarpon' (Fig. 11) (SRGC Forum, 2006). Partly while seeking illustrations for this present article, we also applied the online search engine to *S. macrocarpum*. Of many accurate image representations, this led to a surprising result: a cover photograph (Fig. 3) of that species in *The Plantsman*, a specialist RHS journal, accompanied by an account of the genus in the same issue (R. Heaton & E. Heaton, 2007). This discovery indicates that both epithets are presently employed by Royal Horticultural Society sources. The Heatons, of Devon, England, curate the National

² Although Hieronymus (op. cit.) collected the flowering *S. macrocarpum* syntype himself, he described it as *violaceum* (?), violet, albeit with a question mark signifying doubt. Perhaps he noted down the colour of the tepal zone, and this confused him later when he came to write up his description of the new species from its dried, darkened, colourless state. This obscure fact is most unlikely to be known to horticulturalists though.

Collection of *Sisyrinchium* and its close allies. Rita Heaton (1996) wrote an earlier account, now on an open website, which extols *S. macrocarpum* as one of the most desirable species for cultivation.

Taking all this into consideration, did it seem probable that *S. macrocarpon* E.P. Bicknell had gained an Award of Garden Merit and was widely available commercially, yet not a single description or image of it had been entered on the internet from U.K. horticulture?

Although both *S. macrocarpum* and *S. macrocarpon* are cited by IPNI (op. cit.), we also suspected the nomenclatural legitimacy of two such similar names. Plant name indices such as *Index Kewensis* only ever record published nomenclatural corrections. We therefore consulted the latest ICBN edition (McNeill et al., 2005). This confirmed our suspicion. The two names are to be considered as obligatory homonyms with the earliest correctly published to be qualified as valid and any later examples standing as illegitimate. This situation is addressed separately by the application of a new name in this present edition of *Herbertia* (Watson, 2009).

Our indirect inquiries have also established that *S. macrocarpum* and *S. macrocarpon* are not entered in the RHS New Dictionary of Gardening (Huxley et al., 1992) or the European Garden Flora (V.A. Mattews, in litt.).

Finally, on the point of going to press we have been informed fortuitously that the RHS Plant Finder (e.g. Lord, 2009) has since partially altered its relevant entry from *S. macrocarpon* to *S. macrocarpum* (R. Heaton, in litt.)³. This has virtually removed any lingering doubt, however improbable, as to whether *S. macrocarpon* of Bicknell, or indeed any other sisyrinchium misidentified as such, might have been prominently cultivated in British horticulture. There are accordingly three distinct epithets, only one of them valid, referring to two species: *S. macrocarpon* E.P. Bicknell, homonym illeg. and *S. macrocarpum* Hieron., syn. *S. macrocarpon* Hort., nom. nud. & homonym illeg. Given the last-named, we may assume, to quote the immortal words of Tennyson (1854), that “someone had blunder’d”!

ACKNOWLEDGEMENTS

We gratefully acknowledge information from Christopher Brickell, Tony

³This last-minute confirmation also marginally affects the contents of the accompanying paper on *S. magnicapsulare* (Watson, op. cit.) in these pages, which had already gone to press before these latest details could be incorporated. The new information is not in any way critical, however.

Hall, Rita Heaton and Victoria Matthews on sisyrinchiums in cultivation bearing the epithets concerned, also others who have looked into these matters or passed on our inquiries. Representing The Plantsman as its editor, Mike Grant, as also the Scottish Rock Garden Club, gave permission and facilitated potential reproduction of photographs of *Sisyrinchium macrocarpum*. Photographers other than the present authors who allowed publication of any images used here are duly credited. Our thanks go equally to any whose work was not used. Dr David Lehmiller kindly drew our attention to the many recent publications of *Sisyrinchium* by Ravenna. These might have affected our contents critically. Dr Alan Meerow subjected the submitted work to welcome critical scrutiny.

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SISYRINCHIUM MAGNICAPSULARE J.M. WATSON (IRIDACEAE), A NEW NAME FOR SISYRINCHIUM MACROCARPON E.P. BICKNELL

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ABSTRACT

According to Article 53 of the ICBN Code, the epithets *marcocarpum* and *macrocarpon* must be considered mandatory homonyms. *Sisyrinchium macrocarpum* Hieron. was published in 1881, *S. macrocarpon* E.P. Bicknell in 1901. The latter is therefore illegitimate by virtue of the rule of priority. It may be found as a recognised epithet in current botanical science, and so is replaced here by the new name, *S. magnicapsulare*.

KEYWORDS: Argentina, flora, horticulture, Texas, Willow Spring blue-eyed grass.

INTRODUCTION

While recently investigating *Sisyrinchium macrocarpum* Hieron., an Argentine endemic, in connection with changing the status of its subspecies (Watson & Flores, 2010), we uncovered a problem of nomenclature and identification. It centred on apparent but as yet unconfirmed confusion by influential elements of United Kingdom horticulture between the epithets *macrocarpum* and *macrocarpon*. We discuss this in detail in the same text. *Sisyrinchium macrocarpon* E.P. Bicknell is recorded as an endemic of Texas (Innes, 1985; USDA). Doubt arose as to whether or not two such similar epithets might be considered legitimate by the ruling botanical authorities. As a first step the ICBN Code (McNeill et al., 2005) was studied and provided an unambiguous answer:

“Article 53.”

53.3. When two or more generic or specific names based on different types are so similar that they are likely to be confused (because they are applied to related taxa or for any other reason) they are to be treated as homonyms (see also Art.61.5). If established practice has been to treat two similar

names as homonyms, this practice is to be continued if it is in the interests of nomenclatural stability.

Ex 9. Epithets so similar that they are likely to be confused if combined under the same specific or generic name; *chinensis* and *sinensis*; *ceylanica* and *zeylanica*; *napaulensis*, *nepalensis* and *nipalensis*; *polyanthemos* and *polyanthemus*; *macrostachys* and *macrostachyus*; *heteropus* and *heteropodus*; *poikilantha* and *poikilanthes*; *pteroides* and *pteroideus*; *trinervis* and *trinervius*; ***macrocarpon*** and ***macrocarpum***; *trachycaulon* and *trachycaulum*.” (Author’s emphasis.)

Both epithets are published validly (IPNI), but Hieronymus (1881) published *S. macrocarpon* first, predating Bicknell’s *S. macrocarpon* by twenty years. The former is therefore legitimate by virtue of the rule of priority, and the latter becomes an illegitimate homonym. However, in view of its continuing current significant usage in botany as well as popularly, a new name is provided here.

TAXONOMY

Sisyrinchium magnicapsulare J.M. Watson, nom. nov.

Basionym: *S. macrocarpon* E.P. Bicknell. Bulletin of the Torrey Botanical Club 28: 576 (1901), nom. illeg. Non *S. macrocarpon* Hort., homonym illeg. = *S. macrocarpum* Hieron.

The replacement epithet is intended to approach the form, meaning and spirit of Bicknell’s original Greek epithet *macrocarpon*, ‘large-fruited’, by substituting a close Latin equivalent with the same two initial letters, *magnicapsulare*, meaning ‘large-capsuled’

Discussion:

According to Innes (1985) *S. macrocarpon* is a synonym of *S. ensigerum* E.P. Bicknell. Flora of North America (Cholewa & Henderson, 2002) accepts the latter, which is described as a blue to violet flowered species with a distribution in Kansas, Oklahoma, Texas and NE Mexico. They cite *S. amoenum* E.P. Bicknell and *S. colubriferum* E.P. Bicknell as its only synonyms. Bicknell’s *S. macrocarpon* is not mentioned in synonymy under *S. ensigerum*. However, maximum capsule size given for that taxon is 5 mm, which would seem highly unlikely to have inspired Bicknell’s epithet *macrocarpon* (large-fruited)!

Nor is *S. macrocarpon* mentioned elsewhere in the same treatment of the genus by Cholewa & Henderson (op. cit.). However, the authors include the following comments in their introduction:

“*Sisyrinchium* is a complex polyploid taxon in which the species are not always easily distinguished.”

“Some taxonomists have thought differences too subtle and (have) chosen to lump species ...”

They also devote a paragraph to discussing a species complex centred on Texas which includes *S. ensigerum*. Considering *S. texanum* E.P. Bicknell in particular, they conclude:

“Much more work is needed to resolve ... the true nature of this complex of southern species.”

Nevertheless, the apparent total absence of *S. macrocarpon* from the Flora is all the more puzzling considering other critical factors. As stated, publication of the name is valid according to *Index Kewensis* (IPNI, op. cit.). This inevitably raises expectation of mention in some context in a major Flora of its country of origin. It is officially mapped for Texas in the distribution series of the Department of Agriculture (USDA, op. cit.), where the caption includes its popular name Willow Spring blue-eyed grass. This English-language name is repeated on various websites, and is obviously well-known, even to the lay public.

Despite these mentions, it has not been possible to ascertain whether flower colour of Texan *S. macrocarpon* is yellow, or blue to violet, although the balance of information favours the latter. This doubt is essentially due to the almost certain horticultural-based confusion noted above and explained by Flores & Watson (op. cit.). If indeed so, as our preliminary researches clearly indicate, a second illegitimate homonym will exist: *S. macrocarpon* Hort.

ACKNOWLEDGEMENTS

Dr Alan Meerow kindly reviewed the contents and gave his approval to the conclusions. Mike Grant, editor of *The Plantsman*, provided useful background information. This provoked full investigation of accumulating suspicions about illegitimate homonymy and concluded with the results published here. I am also particularly grateful to my wife and working partner, Anita Flores, for her patient consideration of the text and thoughtful reactions, as ever.

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UPWARD MOVEMENT OF BULBS IN SOIL

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ABSTRACT

Bulbs move themselves downward in the soil profile through the use of contractile roots. Bulbs also have a mechanism to move upward in the soil profile, and this mechanism is described and illustrated for *Hymenocallis duvalensis* and *Zephyranthes candida*.

Key words: Bulb movement, *Hymenocallis duvalensis*, *Zephyranthes candida*.

INTRODUCTION AND DISCUSSION

It is well known that most bulbs and rootstocks have a preferred-depth zone in the soil profile best for their growth and wellbeing. The literature commonly refers to bulbs, corms, rhizomes, and other geophytes pulling themselves down in the soil profile to their optimum-depth through the use of contractile-roots (e.g. Pütz, *et al.*, 1995) or contractile-root tubers (e.g., Pütz, 1998). However, there is scant mention in the literature that bulbs also have a mechanism to move themselves upward in the soil profile if by some accident they find themselves below their comfort-zone depth. When this happens the meristem in the central part of the bulb may elongate into a stolen-like stem that grows vertically up through the soil and at its tip forms a new bulb (Fig. 1). I have observed this phenomenon in *Lycoris*, *Allium*, *Hippeastrum*, *Zephyranthes*, *Hymenocallis*, and other bulbs when, through my ignorance or carelessness, I planted them too deep or when highway-road-grader crews had covered wild bulbs with soil. Pütz (1998) reported that cryptocorms of *Hemerocallis fulva* move upward in the soil "by growing shoot tips", a process somewhat analogous to that reported here for true bulbs.

In the spring of 2005 very-high flood waters in the Ochlockonee River south of Cairo, Georgia, USA deposited a bar of sandy silt over a rather-large colony of *Hymenocallis duvalensis* with which I was familiar. When

I visited the colony in August of 2005, I collected the specimen of *H. duvalensis* shown in Fig. 2. This bulb had a vertical stolen-like stem that had effectively moved the plant upward in the soil profile. The vertical extension was longer than 2 inches (5.1 cm); however, I also observed vertical stem extensions much longer where fluvial deposits had covered bulbs much deeper. I did not remove any of the latter bulbs from the colony.

While dividing and transplanting *Zephyranthes candida* plants from a pot in my garden during February of 2008, I noticed many of the plants had vertical stolen-like-stem extensions moving themselves up in the soil-profile; many of these had a train of new bulbs that had developed one above the other such as the specimen shown in Fig. 3. Note that the lower bulb in the train is degenerating and will eventually disintegrate if the bulbs were maintained in their same relative position in the soil profile. The same fate would eventually become the second bulb in the train. It would be interesting to know what environmental clues bulbs utilize to initiate upward growth.

All photographs by the author.

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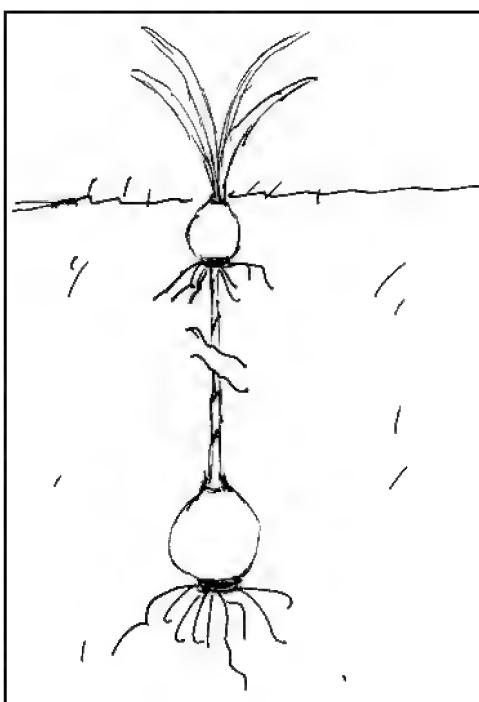


Fig. 1. Movement of bulbs upward through the soil profile by the meristem in the central part of the bulb elongating into a stolen-like stem that grows vertically up through the soil and at its tip forms a new bulb.



Fig. 2. *Hymenocallis duvalensis* collected in August of 2005 from the Ochlockonee River south of Cairo, Georgia, USA with a stolen-like stem that had moved the bulb vertically up through the soil profile.



Fig. 3. *Zephyranthes candida* from my garden with a train of new bulbs that had developed one above the other in order to move the plant upward in the soil profile.

LEDEBOURIA OVATIFOLIA SUBSPECIES SCABRIDA IN KWA ZULU NATAL, SOUTH AFRICA

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All photographs by Connall Oosterbroek

INTRODUCTION

Ledebouria ovatifolia subspecies *scabrida* was described by Crouch et al (2007) in Flowering Plants of Africa. The same plant was given species rank by Venter (2008) who described it as *Ledebouria pustulata*. Venter's name is however invalidly published as it did not take into account the earlier publication by Crouch et al.

Venter's description of this plant is much in keeping with his treatment of the Genus *Ledebouria* in which the concept of species is applied throughout. The view adopted by Crouch et al is significant in the development of botanical knowledge. It represents a novel approach, using theoretical constructs below species level to account for variation in described *Ledebouria* species. This point of departure may be useful in the future for examining the Genus as a whole. It would certainly go a long way towards making sense of variation that cannot be adequately accommodated under the concept of species. The timing of such an innovation is certainly presaged and a point will soon be reached in the construction of botanical knowledge where it will need to be seriously considered. This begs the question of how analysts will need to set about such a task. They will need for example to decide whether concepts such as subspecies and variety are best introduced on an ad hoc basis or as part of a composite whole.

It was decided, against a background of all these factors, to conduct research in the general area from which Crouch et al and Venter had studied the plants for their respective type descriptions. A further objective of the privately funded research was to obtain information on *L. ovatifolia* subspecies *scabrida* for a book currently under research, analysing how South African bulbs and succulents are affected by habitat changes. The

timing of the research, early and late October 2009, fortuitously proved to have been ideally chosen. Most plants had just finished flowering or were in full flower at the beginning of the study and were in fruit, about to seed, at the end of the study.

THE HABITAT NICHE FREQUENTED BY *LEDEBOURIA OVATIFOLIA* SUBSPECIES SCABRIDA

The bulbs occurred in large or small colonies mostly of a few hundred individuals widely scattered across the habitat. The plants were found to occur at the transition between short grassland and woodland growing amongst rocks or else in open patches of short grass. They were most frequent at 1200-1400 m and not encountered at all in lower lying areas at about 900 m. In these places the typical form of *Ledebouria ovatifolia* was found, in one instance less than 5 km from a colony of *L. ovatifolia* subspecies *scabrida*. *Ledebouria ovatifolia* was found on hillsides with a large amount of surface shale grit sparingly covered with sparse tufts of short grass. These places were densely settled with rural villages and heavily grazed by livestock, particularly goats.

Ledebouria ovatifolia subspecies *scabrida* grew either in full sunlight or in the light shade provided by *Acacia* trees. At the flowering and seeding time the grass was usually short, and in most places it had been burned in winter grass fires. After the scabridas had seeded in early November, the grass cover resumed its summer growth and provided some very light shade to plants growing in full sunlight. In early and late spring, September and October, the plants were partly shaded by rocks that frequented most of the habitats.

THE DISTRIBUTION OF PLANTS IN THE HABITAT

Ledebouria ovatifolia subspecies *scabrida* usually occurs singly or in small groups of 2-4 plants. Occasionally much larger groups are found up to 10 or more. These are formed by seeds that germinate around the parent bulbs after a good seed set. Most seeds are distributed much further a field by rapid runoff after thunderstorms which are frequent in this part of Natal during the summer.

The bulbs occur in several distinct and easily recognisable habitats. They grow in thin soil amongst rocks on hill slopes, in large deeper pockets of soil on the summits of hills where the rocks are more widely spaced,

and in open areas under trees usually where there is deep soil. The sites under trees or in their immediate vicinity are usually rich in surface humus from decaying *Acacia* leaves. The bulbs are sometimes locally numerous in this habitat as these places retain moisture longer after rainfall and are conducive to the germination of seeds. They also grow in fissures in rocks where they are laterally compressed into these confined spaces. The soil at the edges of abandoned stone-walled kraals (livestock enclosures) is also densely utilised by the plants where these walls have been built in habitats already occupied by the plants (Figures 1-4).

There is a strong correlation between a full range of habitat niches and an abundance of bulbs. In only one locality examined are there multiple habitat niches available, and, consequently here there are scattered populations amounting to several thousand plants. The latter consists of seedling and juvenile bulbs as well as many adults which always seem to comprise the majority of plants encountered in any population.

The entire area frequented by the subspecies is well grazed by livestock, particularly cattle, donkeys and goats. Grazing has the least impact in places with the greatest number of habitat niches and conversely causes the highest number of problems where niches are at their fewest. It is unfortunate for the plants that multiple niche habitats are scarce. The effects of grazing pressures are discussed fully below.

VARIATION IN *LEDEBOURIA OVATIFOLIA* SUBSPECIES *SCABRIDA*

The research indicates that *L. ovatifolia* subspecies *scabrida* is a remarkably uniform plant (Figures 5-9). The only variation found within and between colonies consists in the length of papillae on the upper leaf surfaces, the density or paucity of their distribution and their colour. The papillae are yellowish green tipped with dark purplish red-brown. Exposure to sunlight seems to be required for the formation of the purplish red-brown colour at the ends of the papillae, and plants growing in shaded positions, under *Acacia* trees, have hardly any of the dark pigment, the papillae appearing a yellowish green. Leaves in light shade or growing in positions where they receive only scant early morning sunlight have little if any of the purplish red brown colour on their papillae.

No colonies examined had any evidence of intergrading with *L. ovatifolia*, a problem so frequently encountered with the classification of plants in other genera in an active state of evolution, such as *Haworthia*.



Fig. 1. The typical rocky grassland habitat occupied by *L. ovatifolia* subspecies *scabrida*. The plants occur amongst the rocks, in the open places which are virtually rock free and under the Acacia trees towards the back of the photograph.



Fig. 2. A close up view of the rocky grassland frequented by *L. ovatifolia* subspecies *scabrida*. The plants are absent from hillside woodland in the background.



Fig. 3. Most of the habitat niches occupied by *L. ovatifolia* subspecies *scabrida* are shown in this photograph. The plants grow on the rocky hillside in the foreground, the level areas of rock free grassland in the middle distance and around the walls of the cattle kraal. They also grow under the Acacia trees shown in the left hand corner of the photograph and on the steep ascending rocky slopes.

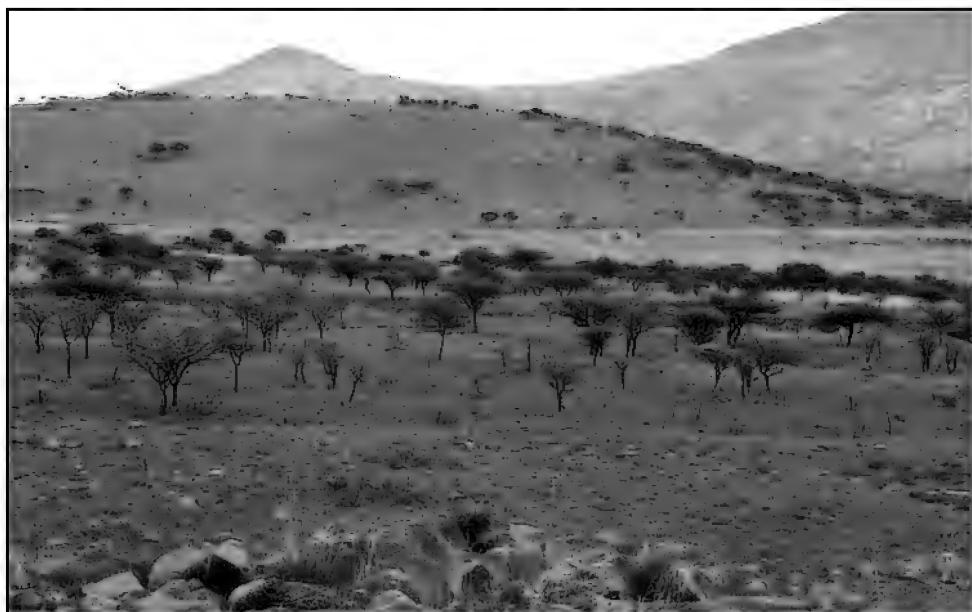


Fig. 4. Two habitats occupied by *L. ovatifolia* subspecies *scabrida*. The plants occur sparingly on the low rocky ridge in the foreground and then again on the slopes and summit of the rocky hill in the middle distance. The habitat in both these places is heavily grazed by cattle and goats. There are very few young plants, most populations consisting of old well established bulbs. The peaks in the distance, one over 1,500 m high, have not yet been searched for the subspecies.

One curious problem however did emerge. A plant was found with postulate leaves amongst typical scabridas (Figure 10). The same variant was also noted from amongst other large concentrations of *L. ovatifolia*. These were found near Roossenekal in Mpumalanga, at the site of the Eagle Granite Quarry, north east of Mooi River near Mount Pleasant in Kwa Zulu Natal, and at Isonywana north of Mount Moriah, about 2 km north of one of the scabrida colonies. These pustulate leaved plants did not appear to be natural hybrids with another *Ledebouria* species and were all single plants. None of them was found in the vicinity of other *Ledebouria* species, and it could be that leaf pustules constituted a very rare expression of variation in the *L. ovatifolia* gene pool.

THE GROWTH CYCLE AND PROCESSES IN THE ENVIRONMENT

Ledebouria ovatifolia subspecies *scabrida* initiates growth in September and flowers in mostly the second half of that month and early October. Isolated plants may be found in flower until the end of October and early November. Winter grass fires are frequent and have the effect of clearing the habitat of moribund grasses and annuals, creating ideal conditions for the subspecies to grow and to flower.

The leaves begin to emerge as the flower buds are initiated and are usually developed to about a quarter of their mature size at the time the bulbs are in full flower. They are fully developed at the time the fruit is ripe and seeds are about to be shed into the environment in early November. Seedlings and juvenile plants lack the papillae on the leaves and are indistinguishable from *L. ovatifolia* at this stage of their development.

Flowing and fruiting usually occurs at the time the first rains of the summer commence, and the seeds are liberated into the environment by runoff after rainfall.

Livestock caused damage at all the colonies observed mainly by trampling leaves, flowers and fruit in the process of development. At one locality heavily grazed by goats, not a single flower of those that were observed had survived trampling. At the largest colony with several thousand bulbs, the limited number of bulbs in fruit was growing in places where the flowers and developing seeds were protected by prominent rocks densely scattered across the habitat. Plants that frequented level places fared the worst, and here the foliage was in tatters in many cases.

Chronic grazing pressures occurred close to rural settlements and in



Fig. 5. Details of the highly distinctive leaves of *L. ovatifolia* var. *scabrida*. This plant has some ripening fruit and was photographed on 28 October 2009.

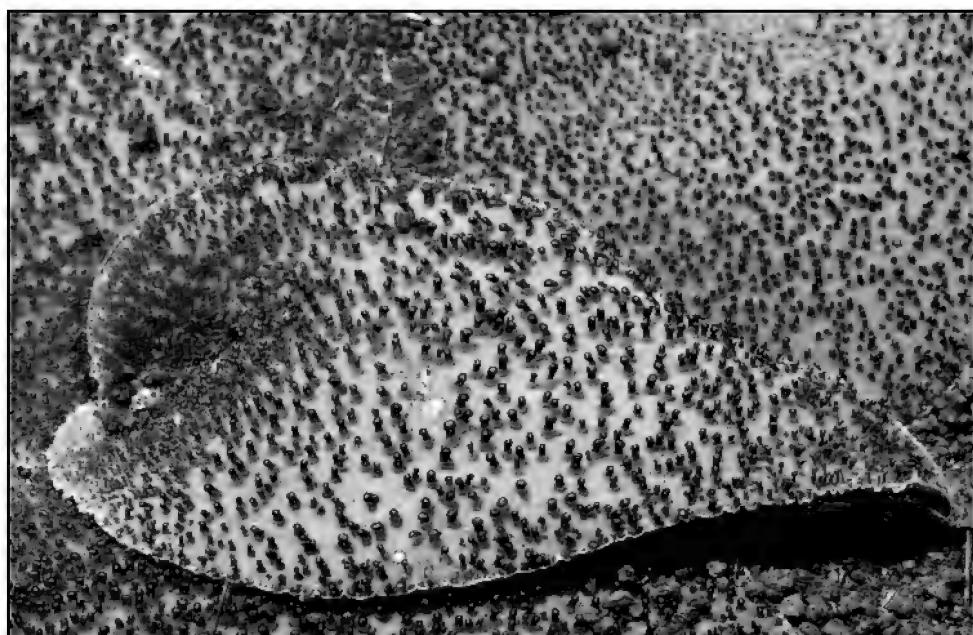


Fig. 6. A close up of *L. ovatifolia* subspecies *scabrida* leaves showing the diagnostic papillae on the leaves which are always a purplish red brown when they are exposed to direct sunlight.

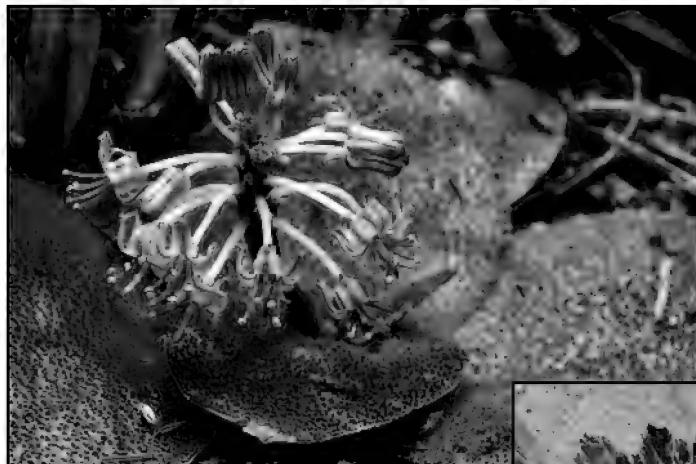


Fig. 7. (Right) This plant is growing with its bulb laterally compressed into a rocky fissure. Even in these relatively protected positions the foliage is damaged by the hooves of grazing livestock as shown here.

Fig. 8. (Above) A late flowering *L. ovatifolia* subspecies *scabrida* photographed on 28 October 2009 at a time when most other plants in the colony were at an advanced stage of fruit development, about 7-10 days before seeding.

Fig. 9. (Below) A very large multifoliate *L. ovatifolia* subspecies *scabrida*. This plant was growing in a shaded position and most of the papillae have remained yellowish green probably as the result of a lack of exposure to sunlight.



these places very few seedlings or juvenile plants were observed. It was evident that the subspecies rarely had the chance to reproduce in these heavily grazed places. It was also clear that the situation was worsening with further houses being built near the habitat, each homestead with its attendant complement of livestock.

The subspecies is affected by trampling but the flat leaves are not grazed. *Ledebouria asperifolia*, a common plant in the general area, is in contrast grazed but not trampled (Figures 11-12). Species such as the latter one, with its erect leaves, are much less susceptible to trampling than those with flat leaves such as the scabridas subspecies. Many of the *L. asperifolia* escape grazing, and there are usually a good number that flower and set seed in a given season.

Preliminary indications suggest that the seed set is very variable in different seasons. It was poor in the 2009 flowering and seeding season with a small fraction of plants setting seed at 2 of the 3 colonies studied. It is probable that over successive years there are seasons of good and poor seed production. There must be some seasons when there is widespread seed production or else it would have been impossible for the large colony referred to earlier to have established itself.

In general terms, plants that have flat leaves pressed to the ground or brittle stems decline sharply as the number of livestock increases. *Aloe dominella* for example is virtually extinct in the area and sometimes a few trampled stems of this plant are seen attempting to re-root and produce suckers.

In addition to problems associated with trampling by livestock, *L. ovatifolia* subspecies *scabrida* seeds are often eaten by lepidopterous larvae. These attacks on ripening fruit are part of a natural control mechanism, but such effects are exacerbated under conditions of habitat degradation. In these circumstances they add to the factors that cause the plants to decline further.

FURTHER RESEARCH

The total distribution of *L. ovatifolia* subspecies *scabrida* may be very small. Present indications are that it is mainly confined to the high ground between Weenen and Muden. Even in this restricted area the plants are absent from a good deal of apparently suitable habitat. Only the lower rocky hills have so far been searched for the plants, and it is not known

whether they occur on some of the high flat-topped peaks in the area such as Umhlumba (1626 m), Intuzuma (1624 m) or Umkholombe (1524 m). These places and their immediate surroundings are well away from villages and livestock and are less susceptible to habitat degradation. If *L. ovatifolia* subspecies *scabrida* were to be found here, its future would be more secure.

Ledebouria ovatifolia is used as a medicinal plant by the Zulu (Cunningham et al, 1996) and is offered for sale on a regular basis at the muti market (medicinal plant market) in Johannesburg. The plants are said to be sourced from parts of Natal. At this time there is no evidence that *L. ovatifolia* subspecies *scabrida* is being harvested as a medicinal plant.

There have not been reports of the subspecies elsewhere, and it seems likely that its distribution range is limited to parts of a small area of rocky grassland between Weenen and Muden. To complete the picture however, further research is required around Muden in similar country. Also it is important to ascertain, should plants be located elsewhere, if they are associated with forms of land use other than those around the type localities.

ACKNOWLEDGEMENTS

I would like to acknowledge the valuable discussions I have had with Mr. Andrew Hankey of the Walter Sisulu Botanic Garden in Johannesburg about *Ledebouria* taxonomy, with specific reference to subspecies *scabrida*. These have added much value to my comments in this paper.

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Fig. 10. The status of this peculiar pustulate leaved *L. ovatifolia* is unclear. This plant was growing about 30 cm away from other typical subspecies scabridas.



Fig. 11. *Leudebouria asperifolia* is very abundant within a few kilometres of where the scabridas grow and is the dominant species in the areas of arid over-grazed thornveld between Weenen and Muden.



Fig. 12. It was very rare to find *L. asperifolia* in the study area with well spotted leaves. This plant, surrounded by well rotted cow dung, was photographed about a kilometre from the nearest subspecies *scabrida* colony.



Fig. 13. A dwarf highly floriferous form of *Ammocharis coranica* is frequent in degraded places in the hot arid low lying Acacia thornveld near Weenen. It shares its habitat with large concentrations of *L. asperifolia* but has not been encountered where *L. ovatifolia* subspecies *scabrida* grows.

NOTES ON *xBRUNSERINE* TRAUB AND A NEW NOTHOGENUS

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Traub (1961, 1963a, 1963b) was credited with establishing the nothogenus for the bigeneric cross between *Brunsvigia* and *Nerine*, *xBrunserine* Traub. In the Latin description for this intergeneric cross, Traub (1963a) indicated that it was a hybrid cross between *Nerine* and *Brunsvigia* with intermediate features, but in the accompanying English description, he specified that it represented crosses between species of *Nerine* and *Brunsvigia rosea* (Lam.) Hannibal. In a separate account, Traub (1963b) elaborated that crosses had been made by him and others between species of *Nerine* and three species of *Brunsvigia*: *Brunsvigia rosea* (Lam.) Hannibal, *Brunsvigia major* Traub, and *Brunsvigia x parkeri* W. Wats. ex Traub. In one article, Traub (1961) reported on seed production where he crossed *Nerine filifolia* with other *Nerine* cultivars, with *Brunsvigia rosea* major, and with two clones of *Brunsvigia x parkeri* 'Hathor'.

According to current nomenclature, Traub never actually succeeded in breeding a true *xBrunserine*. *Brunsvigia rosea* and *Brunsvigia major* are now recognized as being *Amaryllis belladonna*; and *Brunsvigia x parkeri* is now classified as *xAmarygia parkeri*. So in effect, Traub actually produced and described *xAmarine* (*Nerine* x *Amaryllis*) and trigeneric hybrids (*Nerine* x *Brunsvigia* x *Amaryllis*). The holotype cited by Traub for *xBrunserine* was *xBrunserine tubergenii*, which today is known as *xAmarine tubergenii* and is a popular bulb especially in the United Kingdom. Whether or not any of Traub's trigeneric hybrids remain in cultivation is unknown, but if they survive, they deserve a new nothogeneric name of which the following is proposed:

***xTraubara* Lehmiller; nothogenus nov.**

Representing trigeneric hybrids between *Nerine*, *Brunsvigia* and *Amaryllis*.

Reference: Traub, H. P. 1961. Plant Life 17:105.

Satoshi Komoriya, friend of Herbert Medalist Shuichi Hirao (see *Herbertia* Volume 61, 2007), has been interested in hybridizing bulbs for many years. Komoriya's hybridizing accomplishments with *Gloriosa* and *Lachenalea* are detailed elsewhere in this issue of *Herbertia*. The acquisition of the latter articles was coordinated by Shigetaka Sasaki, who acted as interpreter-intermediary, and during the course of events, Sasaki mentioned that Komoriya was also active in intergeneric hybridization. This led to the disclosure and subsequent images of *xBrunserine* which Komoriya had made by applying pollen from *Nerine sarniensis* hybrids onto *Brunsvigia marginata* (Fig. 1-4).

That true *xBrunserine* do exist should not be surprising. DNA sequencing and phylogeny studies (Meerow & Snijman, 2001) demonstrate that the two genera are closely related. In fact, Herbert (1837) classified *Brunsvigia marginata* as a *Nerine*, although he never observed it as a living plant; he based his analysis upon a drawing and observations of others. There are currently no reports on DNA sequencing of *Brunsvigia marginata*; although taxonomic studies support its classification as belonging to the genus *Brunsvigia* (Dyer, 1950 & 1951; Snijman, 2002); perhaps DNA sequencing should be performed to verify that *Brunsvigia marginata* does not have an unusual genetic makeup.

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Fig. 1. *xBrunserine 'Elephant Giraffe'*, a bigeneric hybrid between *Brunsvigia marginata* and a *Nerine sarniensis* hybrid effected by Satoshi Komoriya. Photograph by Shigetaka Sasaki.



Fig. 2. *xBrunserine* 'Elephant Giraffe' and Satoshi Komoriya. Photograph by Shigetaka Sasaki.



Fig. 3. Leaves of *xBrunserine*. Photograph by Satoshi Komoriya.



Fig. 4. Unnamed cultivar of *xBrunserine* bred by Satoshi Komoriya. Photograph by Shigetake Sasaki.

GROWING DRIMIA MARITIMA IN SWITZERLAND

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There are two main forms of *Drimia maritima* (syn: *Urginea maritima*, *Scilla maritima*), the slightly smaller type with grapefruit sized white or pale yellow bulbs, and the much larger, giant variety or 'Red Squill' with taller flower stems and huge bulbs; the latter can easily grow much bigger than a football. They can, in fact, grow so big that just carrying them down to the garden to plant them constitutes a day's exercise! It is the larger variety that I will be talking about in this article.

In February 2005 I was making one of my many yearly visits to the local garden centre, looking at the recent arrivals of bulbs and perennials. Suddenly, I was struck by an amazing sight, a pile of about 10 bulbs of *Drimia maritima* 'Red Squill' (Fig. 1). Huge bulbs, weighing several kilos each! All the bulbs were already sprouting leaves, so were not completely dormant, but they were still plantable. I could of course not resist purchasing a bulb, even though they were fairly expensive (80 CHF a bulb, which is about \$80). They were, however, well worth every penny. Even the woman at the cash machine was highly amazed by the hugeness of the bulb as I was paying for it!

I had previously grown two bulbs of the smaller variety of *D. maritima* in the ground in 2001. However, that year, we had one of the coldest winters on record since the mid 80's, with temperatures of -15°C, which killed the bulbs instantly. Even though drimias are said to withstand a few °C of frost, this was too much for them. Remembering this, I decided to plant my newly acquired treasure in a very large pot, which I could bring into a frost free place over winter.

The bulb was soon planted up, and with the arrival of spring, its large leaf rosette increased further in size, making the plant look almost like a pineapple planted in a pot. Even in leaf it was highly impressive.

After dry summer dormancy, at the beginning of September, a bud started erupting from the centre of the bulb (Fig. 2). This bud grew quickly and soon developed into a dark brown flower stem, with several

small whitish buds on it. The stem continued to elongate, reaching approximately 120 cm at its most (Fig. 3, 4 & 5). The flowers opened gradually up the stem, a bit like an *Eremurus*, which it closely resembled. After about 3 weeks in flower, the flower stem started fading away, just as the first leaves were showing beside the base of the flower stem.

In about early November, it started becoming cold, so not wanting to risk loosing the bulb, I took the pot into a small garden hut with heating. As I lifted the pot, I discovered that one of the very vigorous, large fleshy roots had made its way through the pot's drainage hole and had burrowed quite deeply into the ground. This is how *Drimia* manages to obtain adequate moisture and nutrients in the wild, where it grows by the Mediterranean Sea in very rocky, dry places. It plunges its deep searching roots extremely deep into the soil, in a similar way to a tree or large shrub. In this way bulbs manage to survive and multiply, living on for decades in the same spot, eventually forming large clumps.

My *Drimia* re-flowered successfully in August/September 2006, with a much taller flower stem, reaching over 170 cm tall. However, since then, it has not re-flowered, so in the summer of 2008 I repotted it in a new gritty soil mix, removing dead roots and applying liquid fertiliser during its growing period, in the hope that it would re-flower soon.

The main problem with growing this plant is that it has its main growing period from October to April, with its peak growth in December and January. This means that it is quite tricky to grow if you don't have a cool greenhouse where the leaves (which really do get huge as well) can receive enough light. They easily acquire a white tint from the lack of light, which is not good for the bulb's reserves, as the whitish leaves are not efficient enough to replenish the bulbs reserves and promote flowering. However, this year the latter problem has so far been avoided, due to the fact that we have had one of the warmest autumns on record here in Switzerland since 1900. This has meant that the *Drimia* pot was able to remain outside where the bulb grew large, lush, dark blue-green leaves (Fig. 6) in the warmth and sunshine until the first week of December, when it was brought in, as colder weather with light frosts was forecast.

As I write, on the 13th of December, we have only had one very light frost a few days ago, with 0°C, although they expect -4°C next week, and as they say, "finally" some colder weather. So the *Drimia* pot is now in the garden hut, where it will stay at least until the end of February or

beginning of March, by which time the leaves will probably be even larger and hopefully will not have suffered too much from the lack of light.

I recently acquired *Merwilla plumbea* (syn. *Scilla natalensis*), which can “almost” be referred to as the blue equivalent of *Drimia maritima* (although the flowers are more spread out along the stem). It will be very interesting to see how it grows, and given that it is winter dormant, it might not be as tricky to over winter as *D. maritima*.

Despite being so tricky to over winter, *D. maritima* is an excellent plant, highly spectacular both in flower, leaf, and in the dormant state, and a single bulb in a large pot will definitely make any garden visitor stop in their tracks to admire it, 365 days a year.

All photographs by the author.



Fig. 1. *Drimia maritima* bulbs at the nursery, waiting to be bought.



Fig. 2. *Drimia maritima* in September 2005, showing its first flower scape.



Fig. 3. *Drimia maritima* flower stem in September 2005.

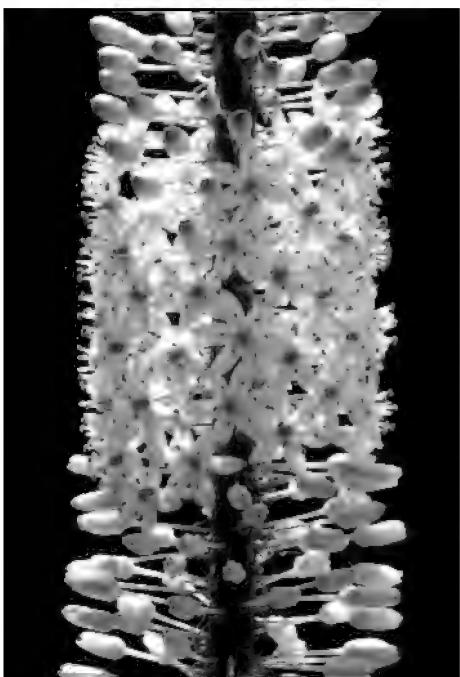


Fig. 4. Close up of the 2005 flower stem.



Fig. 5. A closer look at the flowers.



Fig. 6. The *Drimia maritima* bulb sprouting huge leaves in December 2009.

NOTES

BULBS

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COVER PHOTO
Clivia ‘Green Clouds’ by Victor Murillo

FIRST WORDS

Tony Palmer - Editor

Isn't that a stunning picture on the cover? *Clivia* 'Green Clouds' bred by Victor Murillo. I will let Victor tell you all about it:

"*Clivia* 'Green Clouds' has got to be one of my favorite selections of a Green Yellow. The plant has some great characteristics that any breeding program would benefit from. The nice sturdy umbel that is brought together with 4" flowers is an heirloom in itself. 'Green Clouds' has opened the eyes of many important Clivia people from around the world. 'Green Clouds' is a Group 1 Yellow that passes on its dominant green traits as a pollen and a pod parent. 'Green Clouds' stands out in the breeding category, because nowadays many Group 1 Green Yellows are not passing on their Green genes. That is why 'Green Clouds' is a very valuable plant in the Clivia world today; not only because of the green traits, but because of the overall presentation of the plant. This plant is a result of using my Original Vic Daniele's Green Throat Yellow, with a beautiful reflexed Clean Yellow. 'Green Clouds' is in a class of its own."

The plant is registered in the Clivia Register that is upheld by Ken Smith in Australia, with the following entry for 'Green Clouds':

Registered Cultivar: A green tinged yellow selection bred by Victor Murillo using Vic Daniels yellows. The plant produces large, 100mm (4 inch) dia. flowers of a green tinged yellow with very broad tepals that average between 23 - 30mm width. The green tends to run from the throat to the outer tips of the tepals. Green is passed on when used as a berry or pollen parent. Each large bloom is held in a sturdy umbel and the flowerhead stands out from a distance. It is a vigorous grower with broad foliage of more than 115mm width. It was named because the flowers have dominant green tonings.

If you would like to look further at the Register the link is
<http://cliviasmith.idx.com.au/docs/CliviaRegister200803.pdf>

We don't have an article on clivias this time, but I hereby publicly invite Victor to write one for the next issue!

A new feature in this issue is for authors to name their top 5 favourite bulbs that they grow, together with pictures and a paragraph or two about how they grow them. Three members have contributed – Andy Houghton, Erna Berg and myself. I hope you enjoy this and that you will be spurred on to write about your own favourites next time.

Then Dave Lehmiller tells us all about his December 2008 visit to Cairns in Australia with his wife Nancy, illustrated with some interesting and unusual photos. Once again I urge any of you who have made interesting trips recently to tell us all about them. Please don't be shy!

Next a piece by Graham Duncan on the rare bulb, *Pseudogaltonia clavata*. What an absolutely superb plant it is and as usual Graham gives us very comprehensive details about its features and cultivation. Just wish I could have one!

Our feature article this time is on *Crinum* by Joe Shaw and Marcelle Sheppard. This is a revamp of an article that first appeared at the Web site of the Botanic Garden of Houston. Once again I am green with envy at the beautiful plants that are now available but that we are never likely to see in New Zealand because of the draconian restrictions on plant importation these days.

All this in a double issue which means we have finally caught up with our publications and will keep them up to date from now on. You can help immensely by contributing whatever you can about bulbs. Many of you write screeds of text on the online forum and it really is no harder to write for BULBS, but it will reach an even wider audience.

Thanks and all the best to you all for 2010.

IBS MEMBERS WHO MADE CASH DONATIONS TO VARIOUS FUNDS.

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MY FAVOURITE 5 FLOWER BULBS

In November last year on the IBS Forum I suggested that members might like to share with us the top five favourite bulbs that they grow. I know it is a somewhat impossible question and really only a snapshot in time, but three members took the plunge and here are their choices.

Andy Houghton from Evesham, UK



Cyrtanthus elatus

Easy enough to grow and fairly easy to find. It seems to get better and better each year. I grow mine in a variety of composts, ranging from pure peat, a peat/perlite mix and new for this year a peat free mix using composted wood. I tend to give plenty of water during spring and summer, then dry them out a little over winter. That way they stay evergreen (except during very cold spells). They produce offsets profusely, and still manage to throw up 2-3 flower scapes fairly regularly.



Hippeastrum 'Germa'

I tried this a few times and managed to kill them all, but after doing a bit of background reading, I tried a very well drained compost mix (60% Seramis, 20% vermiculite and 20% peat) and they did surprisingly well. I think the trick is to get the compost warm to

get the roots growing, and away you go. As soon as the pot was full of roots, a scape appeared and grew quickly until it produced 5 lovely long-flower buds. I kept it cool after that and the flowers lasted a good 2-3 weeks.

Lilium pyrenaicum

The only lily I grow. I only bought it as I thought the flowers were a lot bigger than they really are! I still wouldn't be without it though. It arrives every year, then flowers its head off. I was a bit disappointed the first year I had planted it, because I had to bend down to have a good look at the flowers. I have now planted it in an old belfast sink by the front door, which is raised up a bit, so I can sit with a cup of tea and admire the flowers.





Hippeastrum papilio

I must have between 10-12 bulbs from different sources. All have managed to flower once, but I have never managed to flower them again. I have repotted them in a different compost mix this year and have watered them a bit more than I would with other bulbs, and so far they seem to be doing a lot better. They even managed to come through a winter of heavy frosts with no protection. They are worth it just to see the spike appearing, and then producing those wonderful flowers



Sprekelia formosissima

One of the first Amaryllids I saw in flower. I used to work in a rare plant nursery where I was first introduced to the Amaryllid family. I saw this and couldn't believe it wasn't a plastic flower someone had planted in a pot. I managed to get some bulbs (harder than it seems in the UK! - not anymore though) and potted them in a normal mix of peat and perlite, and waited. My wife wasn't that impressed faced with potfuls of thin grassy like foliage spread around the garden, but even she was impressed in the first year I grew it as I had managed to get 10 scapes in one large pot - fantastic!

Erna Berg who is Dutch but lives in the south of France



The climate is said to be mild in the South of France. So it is for us humans, but for plants life is not all that easy, at least not in our garden. The soil here is poor and has no depth; the heat can be fierce; the winds are often violent; there is not much rain and occasionally we have frost. Our land consists of quite a bit of rocky hill and around the house some 150 square meters have been turned into a garden of some sort.

After seven years and a great number of deaths I have given up on many plants. The ones I really want, in spite of everything, I grow in pots so that I can keep an eye on them. Among them many bulbs like *Hippeastrum* which I try to keep alive. I can never resist a *Hippeastrum* when it is small flowered in subtle colours. In my opinion the most beautiful of all is called 'Misty'.



I am no good at all at propagating, but I am quite good at enjoying and what I enjoy most is usually small and dainty. Here I go!

Number one favourite in the bulb department is *Leucojum autumnale* which these days is called *Acis autumnale*. Tiny white bells, with a hint of pink, flowering from the end of June onwards. I saw one today and it is almost

November! They do their own propagating and I'll find them wherever the place is watered regularly. You practically have to go down on your knees to see them, but I adore them: small, brave and strong!

Number two is *Oxalis rosea*.

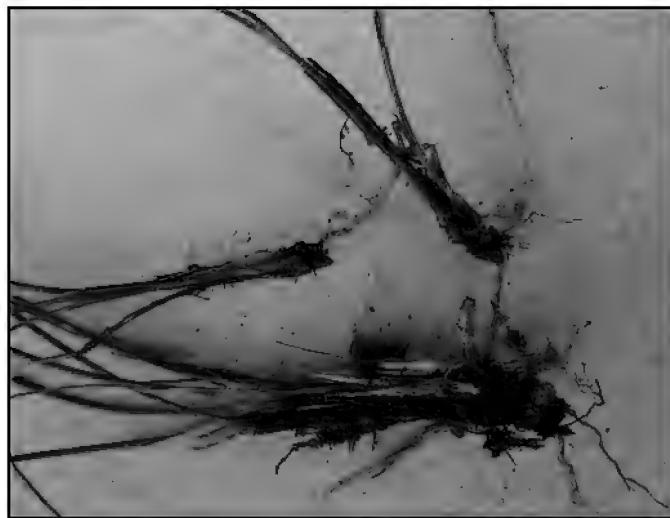
This beauty will start in March and keeps going until it is too hot. It then takes a two months' rest in July and August and has another go at it until frost arrives. The plants themselves grow in size and now and then I find a new one, but they never become a nuisance. It is the easiest, loveliest bulbous plant in this area.





In spring I have *Gladiolus tristis*, a sad name for a happy thing. The flowers appear at the end of March and will last over a rather long time - four, five weeks. They are a pale yellow and have a heavenly perfume, but only at night. One drawback is that those hateful caterpillars that come out at night and roll themselves up when disturbed - I have no idea what they are called but they are real pests - love the flowers for a midnight snack . Well, you can pick those up when you arrive to smell them, the flowers I mean. The clumps of the *Gladiolus* gradually grow larger and the species will also expand by its seedlings.

Then my fourth choice. A crocus which only lasts for a week or two, but what a beauty! *Crocus goulmyi*, an autumn flowering species. It does quite well when it receives a regular gift of water, but gradually disappears when it is left on its own. Apart from being so lovely, its one real good quality is its ability to keep standing up even in rather heavy rain.



I have not been able to find many bulbous plants that will grow well on our rocky hill without any special care - that is to say without a regular gift of water! But we have a mystery plant here: *Aphylanthes monspeliensis*. It clearly belongs to the lily family, but there is no bulb and it dies

when transplanted. Yet it must produce seeds as I find a youngster once in a while, but I never see any seed! I have hundreds of them and in the glorious month of May the hill is covered with tiny blue stars. My fifth favourite!

Tony Palmer who lives in Auckland, New Zealand, on 5 acres of land which is mostly native bush with about 1 acre in gardens and nursery.

My choices represent as much my 5 favourite bulbs that I also have a high resolution picture of! Just about impossible to choose but great fun trying.



Worsleya rayneri

This has to be one of my all time favourite plants let alone bulbs. Our first *Worsleya* bulb we have had for over 30 years and it is now in a half wine barrel, with several offsets. We have also raised many plants from seed, usually using the flotation method with germination happening in a couple of weeks or so. We have flowers most years and exchange pollen with other growers. We have not found them difficult to grow in a well drained mix, but our climate helps of course. The main enemy is the narcissus bulb fly.



Paramongaia weberbaueri

This crazy plant from Peru seems a bit out of proportion with its ridiculously large daffodil-like flowers on shortish stems. With us it blooms at the same time as the broad grey-green leaves appear in early summer. It is really beautiful. We have only ever grown it in pots but will soon have enough to try it out in the garden which should work as we are frost free. It seems to multiply by offsets quite freely but we have never had any seed set much to the disappointment of many people!

***Moraea villosa* ‘Zoe’**

I've never really found a moraea that I don't like, but this form of *Moraea villosa* is exquisite. These winter flowering bulbs from South Africa are very rewarding in pots or in the open ground and are mainly reasonably easy to grow. We lift them every year, dry them out, and repot in early autumn. Seed germinates well if fresh.





Weldenia candida

This remarkable summer flowering tuberous-rooted plant is definitely one of my favourites for its neat rosette of leaves amongst which nestle what must surely be one of the purest white flowers of all. The *Tradescantia* shape gives away the fact that this plant belongs to the

family Commelinaceae. It survives our wet winters whilst dormant, but would probably need a dryish, well drained spot if planted in the garden. Propagation by division whilst dormant. We have never seen any seed.

Lachenalia thomasiae

This is a comparatively new species which we grew from South African seed. We are slowly building up the quantity. It is a vigorous robust plant with flower heads around 15 cm long. I have chosen it because it is so new and is very striking, but there are many other *Lachenalia* species amongst my favourite bulbs.

We have only grown it in pots and in an unheated greenhouse. Our main fear with our Lachenalias is winter hail and heavy rain so we are growing more of them under light cover now.



A VISIT TO CAIRNS, AUSTRALIA

David Lehmiller – Nancy Lehmiller

In early December 2008, following a field trip in Australia's Northern Territory in the company of IBS Member Jim Lykos, we visited Cairns, Queensland for a six-day sojourn. No sooner had we checked into our hotel accommodations when the telephone rang. On the other end were Fanie and Julye-Ann Venter, eagerly waiting to introduce us to the sights of Cairns. Our e-mail friends were suddenly transformed into real human beings. We left our suitcases unopened and jumped into their vehicle in anticipation of excitement and new friendships.

First on the itinerary was a coffee plantation estate where Julye-Ann had been recently employed. After a relaxing break in the coffee shop, we toured the estate, learning that the proprietor was planning to develop a portion of the grounds into a botanical garden in order to attract more tourists and visitors. Near the main estate was a large fenced area that was used to house orphaned wallabies and small kangaroos. As soon as we entered the pen, one friendly young wallaby immediately greeted us and became our close companion while we walked around to observe the other orphans. Obviously, orphaned wallabies were an attraction all to themselves.

Then we set off for Lake Barrine, a crater lake formed from an extinct volcano. The lake was approximately 1 km in diameter and was surrounded by lush tropical rainforest. We arrived just in time to embark on a boat cruise around the shoreline of the lake. A guide detailed the ecology and wildlife as we traveled, and indeed we observed snakes (pythons), various birds, turtles, fish and eels. A convoy of wild ducks escorted us, ready to pounce on the bread crumbs occasionally offered by the guide to attract the turtles. Following the cruise, we ate a delightful lunch in the on-site restaurant. Then we walked through the rainforest along a trail circumventing the lake. This was highlands rainforest, populated by gigantic trees. Basket fern clusters grew in many trees. We were hoping to see a musky rat kangaroo, common to the locality, but not that day. Fanie was delighted to discover various interesting fungi growing in the underbrush debris and took many photographs. As we parted company that evening, our friends gave us a copy of the latest edition of



Fig. 1. Planting of *Crinum xanthophyllum* in public access area of Cairns. (Photo by Fanie Venter.)



Fig. 2. *Proiphys* species growing at Hartley's Crocodile Adventures. (All remaining photos by the authors.)



Fig. 3. A friendly orphaned wallaby.



Fig. 4. Eastern Water Dragon (*Physignathus lesueuri*) at Cairns Wildlife Dome.



Fig. 5. Male parrot (*Eclectus roratus*) at Cairns Wildlife Dome.



Fig. 6. A jumping crocodile at Hartley's Crocodile Adventures.



Fig. 7. Black-necked Stork (*Ephippiorhynchus asiaticus*) at Hartley's Crocodile Adventures.



Fig. 8. Black Swan (*Cygnus atratus*) at Hartley's Crocodile Adventures.

their book from homeland South Africa: Making the Most of Indigenous Trees, by Fanie & Julye-Ann Venter, ISBN 1875093338.

During our Northern Territory trip, Jim had accomplished most of the driving, with Dave only venturing occasional stints on rural roads. Now, we were on our own, driving on the wrong side of the road, on the wrong side of a rental car, in city traffic where dreaded “roundabouts” had to be maneuvered. Egad! But we survived.

The following day we planned the remainder of our adventure, scouting out the wharf area and making assorted reservations. It was definitely a tourist city, with many restaurants, hotels and curio shops located near the esplanade recreation area fronting the beach. *Crinum xanthophyllum* was a common border plant in public garden areas. It was an intermittent rainy day, somewhat limiting our activities, but making it an ideal time to tour the Cairns Wildlife Dome on top of the Reef Hotel – a 5 star hotel with its own “all-weather” zoo under a dome. It was designed as a close encounter zoo, with many Australian birds, lizards, marsupials, etc. either freely roaming or confined within controlled access chambers – except for a giant crocodile lounging in a huge glassed pool and a smaller fresh water crocodile in a flowing stream enclosure. During the return stroll to our hotel, we shopped in a large, open air, farmers’ market and purchased a bag of huge fresh mangoes.

No trip to Cairns would be complete without a day at the Great Barrier Reef. Not being swimmers, we knew that we would not be able to take full advantage of a day trip to the Reef, but we wanted to see this unique wonder of the world. We boarded a large engine-powered catamaran at the wharf and enjoyed the 1.5 hour trip to a floating pavilion-platform adjoining the Reef. Although we did not snorkel at the Reef, we went on a glass-bottom-boat ride meandering about portions of the Reef, and we took an optional helicopter flight from which we could appreciate the vast magnitude of the Reef’s size. It was an interesting experience, but there was one disappointment: Unknown to us, the trip we selected took us to a platform located in an area where coral bleaching had occurred, and consequently we were not able to appreciate the diversity of colors usually found at the Reef.

One of the most entertaining experiences we had was at Hartley’s Crocodile Adventures, a crocodile farm located north of Cairns. It was originally a commercial crocodile farm for hides and meat, but later it had



Fig. 9. Waterfall in rainforest area viewed from railcar.

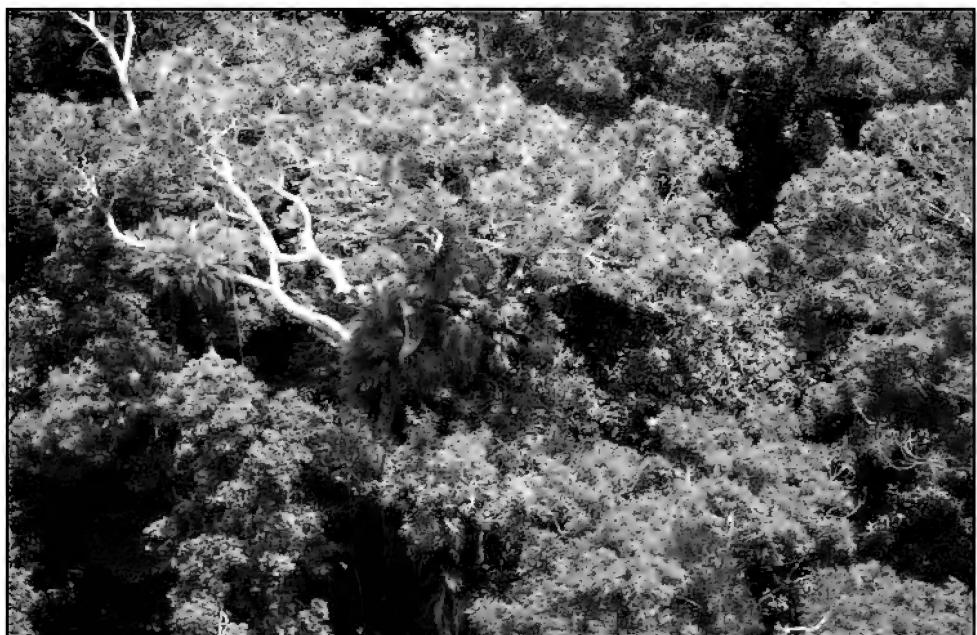


Fig. 10. Close-up view of rainforest via cablecar.



Fig. 11. *Nepenthes* species in orchid house at Flecker Botanical Gardens.



Fig. 12. A pink cultivar of *Etlingera elatior* at Flecker Botanical Gardens.



Fig. 13. *Aerides maculosa* in orchid house at Flecker Botanical Gardens.



Fig. 14. *Heliconia wagneriana* cv.'Turbo' at Flecker Botanical Gardens.



Fig. 15. *Zingiber spectabile* at Flecker Botanical Gardens.

expanded into a crocodile entertainment park and wildlife sanctuary. The highlight of the visit was a boat tour though a network of bayou-like-water channels where crocodiles were viewed in native type habitat, with the major attraction being the opportunity to observe "jumping crocodiles." The latter occurs when a crocodile is attracted to the boat by a dead chicken suspended on a rope from the end of a cane pole. By manipulating the elevation of the chicken above the water level, the crocodile will actually "jump" straight up out of the water to 7 or 8 feet to grasp the chicken -- an amazing spectacle, to say the least. Quite naturally, the boat was surrounded by transparent plastic shielding to keep the crocs from jumping into the boat and devouring the passengers. In the accompanying nature preserve, we saw many interesting wild birds. There was also a small botanic garden on the premises which was in its embryo stage, but it did harbor a blooming *Proiphys* species. Many *Crinum pedunculatum* were planted on the grounds and were noted to be growing in the bayous.

Cairns is very proud of its tropical rainforest, and there are active efforts to preserve it. In northwest Cairns, there is a combination excursion between Cairns and Kuranda available to view coastal rainforest: the Kuranda Scenic Railway and the Skyrail Rainforest Cableway. Both the railroad and the cable lift traverse low mountainous rainforest, offering visitors an opportunity for spectacular viewing. The railway winds through difficult and treacherous terrain including a long tunnel. The entrance-exit locations make it a simple endeavor to ride one attraction to Kuranda, spend a few hours visiting the native curio shops and restaurants, and then to return via the other ride ... exactly as we did. In fact, one could spend an entire day in Kuranda, browsing native artifacts, shopping in the handicraft markets, and even watching Aboriginal dancers.

Jim had recommended that we visit the botanical gardens in Cairns, and the latter was the final destination of our vacation. The Cairns Botanic Gardens represented a recent consortium between Flecker Botanic Gardens, Centenary Lakes Botanic Reserves, Rainforest Boardwalk, and Tanks Art Centre. It was another rainy day, which somewhat hampered our tour because the gardens were spacious. The gardens contained impressive collections of various native and exotic tropical plants, including bamboo, ginger, ferns, flowering trees, heliconia, shrubs and vines, and there was an Aboriginal Plant Use Section. We commenced our tour at the Orchid House and concluded with the Rainforest Boardwalk.

The latter was of particular interest since it afforded an opportunity to view pristine Pandanas Swamp Forest where *Crinum pedunculatum* was indigenous.

Prior to our departure, we again visited the Venters, who took us on a brief tour to observe some of the high-end vacation resorts frequented by the rich and famous. Afterwards we visited a local site where *Crinum angustifolium* was indigenous, a sandy field which was occasionally inundated following heavy storms; the bulbs were not flowering though. After saying farewell to our new friends, we disembarked on the long trek home: Cairns to Guam to Hawaii to Houston.



Fig. 19. The authors while riding in a railcar on Kuranda Scenic Railway.



Fig. 16. Entrance into Rainforest Boardwalk.



Fig. 17. *Crinum pedunculatum* indigenous to Pandanas Swamp Forest along Rainforest Boardwalk.



Fig. 18. Fresh water lake in Centenary Lakes Botanic Reserve.

PSEUDOGALTONIA CLAVATA

Graham Duncan

Photographs by the author

Endemic to southern Africa in the northern Richtersveld, Namibia and Botswana, as well as Angola, *Pseudogaltonia* is a monotypic genus of the Hyacinthaceae, with *P. clavata* its sole member. This summer-growing, winter-dormant species has a rather large, egg-shaped bulb up to 120 mm in diameter with a fibrous outer coat and sturdy fibrous neck, resembling a coconut. The coarse fibres or bristles covering the bulb develop as a result of splitting of the outer bulb scales. The bulb is very poisonous, containing a cardiac glycoside that results in irregular heartbeat and sudden death in cattle (and, no doubt, in humans). An attractive rosette of six to ten erect, greenish-grey, broadly lance-shaped leaves appears in early summer, followed in midsummer by a robust stem carrying an elegant, dense raceme of tubular, greenish-grey flowers at the tips of spreading flower stalks. The very long perianth tubes contain nectar in their distinctly inflated bases, and the open flowers facing downwards. Individual flowers last about ten days and once flowering has taken place, the ripening seed capsules re-orientate themselves to face upwards to facilitate wind dispersal of the rounded flat, black papery seeds in late summer.

The plant has suffered a number of name changes since its original publication as *Galtonia clavata* by Maxwell T. Masters in *The Gardener's Chronicle* in 1884. The genus name *Pseudogaltonia* is descriptive of its superficial resemblance to *Galtonia*, from which it differs primarily in the point of attachment of the stamens to the perianth tube. In *Pseudogaltonia* the perianth tube is curved and the stamens arise from the throat of the tube and are slightly exserted, whereas in *Galtonia* the perianth tube is straight with the stamens arranged in two rows at different levels, and included within the perianth. *Galtonia* comprises four species (*G. candicans*, *G. princeps*, *G. regalis* and *G. viridiflora*) and is native to the eastern and northern parts of South Africa, and Lesotho, and the two genera have different chromosome numbers (2n = 18 in *Pseudogaltonia* and 2n = 16 in *Galtonia*).

Known in Afrikaans as 'gifbol' (poison bulb), 'groenlelie' (green lily)



Fig. 1. Close-ups of *Pseudogaltonia clavata* at Kirstenbosch.

or 'slangkop' (snake's head), *P. clavata* occurs naturally in large colonies on dry stony flats, rocky hillsides and in ravines. The bulbs are adapted to survive extremely harsh conditions by remaining dormant through severe droughts that can span many years. The accompanying photographs are of plants originally collected by my colleague Ernst van Jaarsveld in Namibia, now being grown in the bulb nursery at Kirstenbosch.

Reaching a maximum height of 1.3 m, *P. clavata* is very well suited to cultivation in large containers and rock garden pockets in temperate climates, and to greenhouses and conservatories with bright light in colder parts. It has been grown successfully for many years in England in the greenhouses of bulb grower *extraordinaire*, Harry Hay who, to the best of my knowledge, is the only person ever to have documented the time taken for the plant to flower from seed - a staggering 21 years! The bulbs are fairly slow-growing but with feeding, they might hopefully be brought to flowering stage a little sooner in temperate climates. In the Kirstenbosch nursery the plants flower in December and January.

Plant *Pseudogaltonia clavata* bulbs outdoors in frost-free areas in sunny rock garden pockets or in large, deep containers with a diameter of 30 cm. Alternatively, grow them in deep beds or pots in brightly lit greenhouses or conservatories in colder parts. The bulbs are planted in spring and the fibrous neck of the bulb should be exposed. The growing medium must drain perfectly well and a suggested medium is two parts course river sand or grit, one part loam and one part finely sifted compost or finely milled bark. Suggested watering frequency is a thorough drench about once every ten days during the summer active growth period, gradually reduced towards late autumn as the foliage dies back, followed by an absolutely dry winter rest period. Once established, the bulbs like to remain undisturbed for many years.

Propagation is best achieved by seed as offsets are produced erratically. Sow the seeds thinly in deep seed trays or pots and allow the seedlings to establish themselves for three years before being planted into permanent containers or into the garden. Monthly applications of liquid fertilizer of seaweed extract should assist seedlings in reaching maturity faster but should be discontinued once flowering size has been reached otherwise the bulbs will produce luxuriant leaf growth at the expense of flowers. The bulbs aren't able to survive very wet winters such as those experienced in the southern suburbs of Cape Town, eventually succumbing to fungal

rotting, but they will survive inland in drier conditions. The leaves and flowers are hardly ever subject to attack by insect pests. Bulbs of *Pseudogaltonia clavata* are unfortunately not yet easily come by and only occasionally offered by specialist bulb nurseries.

REFERENCE

Duncan, G.D. 2008. The desert coconut. *Veld & Flora* 94 (4): 200–201.



Fig. 2. *Pseudogaltonia clavata* as a container plant, flowering at Kirstenbosch.

CRINUMS

by Joe Shaw and Marcelle Sheppard

INTRODUCTION

Crinums are the hot new garden plant, even though they have been grown in gardens in the southern United States since the 1800s. They are “new” because breeders are producing new colors and types and because botanists are discovering more about *Crinum* species. They are also new because more nurseries are offering them for sale in ever greater variety, and because intrepid gardeners are discovering that these so-called Southern plants can be grow into the central Midwest and the Atlantic states as far north as Long Island. They are “hot” because of their exotic colors and tropical look; because they add a unique look to any garden, and because they lend themselves to no or low-care garden methods.

Crinums are bulb-type plants related to the florists’ *Hippeastrum*.

However, crinums are typically larger plants than *Hippeastrum* and will survive more punishment and cold. In the wild, *Crinum* species are found in Asia, the Americas, the Pacific region, and Australia, but Africa is the home of the most crinums, with species being found from Ethiopia to South Africa and Madagascar.

In the wild, *Crinum* species are found in various habitats including deserts, woodlands, grasslands, and marshes; there are even fully aquatic species. All species share a fondness for water during their growing season. Desert species may be found in areas where a few inches of water may fall in the rainy season, only to vanish and leave the plants in sun-baked, dry soil for 6-9 months or more. Many *Crinum* species form large bulbs that provide insurance against long periods of drought. In dry seasons the bulbs go dormant and outlast unfriendly conditions. Some species are truly tropical and resent frosty weather, whereas others are from warm temperate regions that may experience occasional frosts.

Many crinums (wild or hybrids) will survive cold winters if they have good drainage, proper care in the growing season, and are planted deeply. Jim Shields, at Shields Gardens in Westfield, Indiana, reports that he’s grown some *Crinum* species and hybrids outdoors in USDA climate zone 5 with limited success. Other individuals have reported they grow *C. bulbispermum* ‘Jumbo’ hybrids in Kansas City, Missouri, and *C. x powellii*

plants in Maryland.

Over the past 100 years, breeders of crinums have quietly been at work, using a half-dozen or so species to create some spectacular garden plants. The best bulbs re-bloom from after the spring bounty, have sturdy flowers that hold up in hot weather, a nice fragrance, and large flowers ranging from white, to pink, to red-pink, or even with gaudy stripes.

Gardeners across the United States are rediscovering these pass-along plants as well as some newer hybrids. One trend that has helped increase demand (and supply) for crinums is the Internet. Gardeners are talking to each other and they are talking about crinums. Nurseries that typically offered only "off the shelf" flowers and shrubs in the past have responded by offering these crinum beauties.

There are many *Crinum* hybrids that have been described over the years, and some have picturesque names like milk and wine lily, or Nassau lily. Other garden crinums are found plants - found by collectors looking for durable plants among old homes and businesses. Such plants may acquire wonderful names including 'Regina's Disco Lounge' and 'Shreck'. Sometimes breeders name their creations for special occasions or people; well-known hybrids with such names are 'Elizabeth Traub', 'Emma Jones', and 'Stars and Stripes'.

One feature that makes crinums so useful in American gardens is that hybrids can be especially durable and tough, often surviving for years at abandoned home sites or municipal buildings; such neglected plants often take care of themselves and produce blooms each year. However, when recovered and given care these plants may exuberantly produce flowers.

It is difficult to know how many *Crinum* species might exist; estimates range from 100 to 150. Much of the uncertainty derives from incomplete descriptions and studies performed in the past. However, scientists have begun to address the problem and much clarification has been provided in the last 50 years in the form of field studies and published descriptions.

Most garden crinums are hybrids produced in the past 100 years, or representatives of just a few species that do well along the Gulf Coast, the upper South, the Atlantic seaboard states, and California. It is a wonderful attribute of crinums that they can make such splendid garden plants in many geographic locations, including the Pacific Coast states and the Midwest.

CRINUM SPECIES FOR THE GARDEN

Crinum bulbispermum

Crinum bulbispermum occurs in South Africa where it mostly inhabits seasonally wet grasslands and meadows, or along streams and other bodies of water. Like many crinums, *C. bulbispermum* is often found in areas that are wet part of the year, but quite dry at other times. Also, like most garden crinums, *C. bulbispermum* benefits from frequent watering during the growing season (spring and summer in the Houston area).

Rains may provide suitable water in some areas, but if precipitation is irregular these crinums enjoys a deep soaking every week or so while actively growing. *C. bulbispermum* is a good choice for year-round boggy areas or lakeside plantings; however, it is not a true aquatic plant and like most garden crinums it will survive prolonged drought and neglect.

C. bulbispermum-like plants have become naturalized in parts of the greater Houston, Texas area in old pastures and in roadside ditches. Some of these have large beautiful flowers, held high on sturdy scapes, and they are good re-bloomers. However, others have small, dull (nearly tan or brown) flowers and are not worth growing.

The foliage of *C. bulbispermum* is distinctive. The leaves are blue-green or gray-green, long and tapering to a point; they flow up from the bulb and then arch outwards falling back to the ground in a swirl. Additionally, the foliage is cold-hardy throughout USDA climate zone 9; *C. bulbispermum* is nicely evergreen to the mid or low 20s Fahrenheit.

Plants may make offsets, or they may grow as a single bulb. The production of offsets is apparently uncommon in African plants; perhaps offsetting plants were selected for such a useful feature, or perhaps offsetting results from chance hybridization with other garden crinums.

The flowers of *C. bulbispermum* are delightful and are typically white with pink or dull burgundy stripes on the keels of the tepals. *C. bulbispermum* flowers can be fragrant, sometimes sweetly so. However, some cultivated plants seem to have no fragrance. The flowers are large and somewhat Easter lily-like, opening to face outwards but then suspended downwards like bells.

Flowers can appear as early as March 1 in Conroe, Texas and they may keep on coming until hot weather. If fall is sufficiently pleasant and long (southern areas), *C. bulbispermum* can bloom again after August and throw flowers until frost. Blooming depends upon various factors, including

exactly which plant is being grown: is it a favorite pass-along garden plant or named nursery variety, or is it a plant of unknown provenance found along an East Texas highway?

Various nurseries sell *Crinum bulbispermum* seeds, plants, and hybrids. It is even possible to get seeds directly from growers in South Africa; with good care and growing conditions such plants might bloom in 3-4 years from planting.

Like most crinums, *C. bulbispermum* benefits from regular fertilizer in the growing season. The plants can be fertilized in early spring, about the time redbuds or dogwoods bloom. They enjoy well-composted animal manure, but a cupful of 10-10-10 fertilizer scattered around each plant/bulb is also suitable. They benefit from reapplication of fertilizer in 6-8 weeks (early June), and again in midsummer (late July). Of course, if they have fertilizer they will need adequate weekly irrigation, and plants with such care can grow large and produce many flower stalks each season.

C. bulbispermum does best in half-day or full sun as do crinums in general. Blooms may last longer if they are protected from hot



Fig. 1. *Crinum bulbispermum*-like flowering umbel. (All photos by the authors unless otherwise specified.)

afternoon sun, and garden crinums are sometimes planted so they will receive morning and midday sun only. But such care is not needed and naturalized *C. bulbispermum* plants can be found happily growing in full sun in central or east Texas. *C. bulbispermum* will grow in many soils but does best in rich flowerbed-type soils that have adequate organic matter.

One thing about a *C. bulbispermum* bulb is that it is bulletproof. It may do best with good soils, regular irrigation, and feeding, but the plant will generally do well under many conditions. *C. bulbispermum* can be grown at the edge of a lawn where it receives only water and fertilizer as comes its way from regular lawn care, and such plants typically do well; or *C. bulbispermum* can be grown adjacent to driveways and patios, or in the half shade of trees.

C. bulbispermum is nearly free of pests, and is not usually consumed by deer or other wildlife. However, it can suffer from occasional caterpillar or grasshopper damage that will leave holes in leaves. Additionally, leaves and bulbs can develop ugly fungal lesions upon occasion. For a few plants, the best remedy is to pluck off the offending insect, or cut away any blemished leaves.

Weeds can overgrow many ornamentals, and *C. bulbispermum* is no exception. Though sturdy and durable, crinums should be protected from overgrowth by weeds, which will steal sunlight, water, and nutrients from the bulb. However, even weeds can't stop a durable garden crinum and such a plant may bloom when you least expect it, sending up flowers to tower over the weeds.

Like many crinums, *C. bulbispermum* typically produces a large bulb over time. Grapefruit-sized bulbs are common for plants that have been undisturbed for a few years, and larger bulbs are found in old clumps. The bulbs are usually firmly anchored by huge roots. Such large bulbs are a challenge to transplant, so when you plant crinums think of them as a permanent or semi-permanent landscape feature. It can take a lot of digging to move a large bulb - especially one with finger-sized roots that has pulled itself down into the soil.

Crinum asiaticum

C. asiaticum is a large plant originating from tropical or coastal Southeast Asia but now widely found in tropical and mostly frost-free semitropical areas. It is a semi-aquatic plant, but not exclusively so, and *C. asiaticum*

will happily grow in a well-watered garden. *C. asiaticum* is frequently grown in Florida, along the Gulf Coast of the United States, in Californian, and in Hawaii where its large leaves and copious flowers add an exotic look to gardens.

The leaves of this large crinum can be 3-4 foot long and extend upwards from the central stem. A plant can easily reach 5 foot-tall, with the flowers being held even higher. In time the plants make large clumps of enormous bulbs; bulbs may be the size of small watermelons. The bulb itself is unusual because most of it is above ground. From the basal plate the stout leaves are rolled together tightly to form a pseudostem that can reach a foot or more above ground (a bit like a garden leek). Thus, the “bulb” portion of *C. asiaticum* consists of an underground basal plate and an above ground portion called the pseudostem. Many garden crinums have a pseudostem.

A number of related plants are found throughout tropical parts of Asia; these have sometimes been split into several species, but at other times they have been treated as variants of *C. asiaticum*. *C. pedunculatum* of Australia is clearly related to *C. asiaticum*, and the two species have similarities that include erect (or almost so) leaves. *C. japonicum* is clearly part of this large group of related plants originating from Southeast Asia or the Pacific region.

The giant “procerum-type” plants have been called *C. asiaticum* var. *procerum* or *C. procerum*. *C. procerum* plants can have red or purple-brown leaves and pink-red flowers. They are attractive and beautiful in the garden.

The scapes of *C. asiaticum*-type plants may have 20-50 flowers which are usually white



Fig. 2. *Crinum asiaticum*.

but sometimes with pink or pink-red tints. Probably the variation is the result of many years of cultivation and cross hybridization between selected garden plants. Some named forms can be found in commerce, but it is difficult to know what is being offered for sale and much less so if it is really a representative of an identifiable garden cultivar. Nonetheless, all *C. asiaticum*-type plants seem to be beautiful and floriferous.

C. asiaticum (and *C. japonicum*, *C. pedunculatum*) is easy to grow and tolerates some shade and diverse soils. Additionally, *C. asiaticum* will flourish in a garden setting, in a large container, and along bodies of water (even salt water). Like many garden crinums, *C. asiaticum* is tough and durable, but it generally requires more year-round water than *C. bulbispermum* in order to do its best. *C. asiaticum* can be grown in shallow ponds (up to 15 inches of water, or perhaps more), or in flower beds that receive regular irrigation such as might be provided for well-cared-for roses. Like most garden crinums, *C. asiaticum* can survive years of neglect only to respond quickly to fertilizer and water.

The plant loses its leaves at 25-30 F, and thus is evergreen only in near frost-free areas. Though the leaves may die back each winter the species seems hardy throughout USDA climate zone 9 and well into zone 8. Light frosts will kill the above ground foliage and perhaps part of the pseudostem. However, when warm weather arrives (March or April) leafless plants quickly send up new growth and will flower as the season advances. In warmer areas *C. asiaticum*-like plants can bloom in winter.

General care for *C. asiaticum* is as for almost any garden crinum: provide water and fertilizer during the growing season, and give plants lots of sun. Like most *Crinum* species, *C. asiaticum* will grow and flower with half-day sun or less but seem to flower better with half-day sun or more.

The flowers are white and have a 3-4 inch-long floral tube with protruding stamens. The spreading parts of the tepals (the limb) may be 2-3 inches-sometimes spreading starfish-like.

Crinum scabrum

C. scabrum is one of the superstars of the flower world because of its amazing stripes. Each magenta or pink-red stripe begins near the tip of a tepal and extends deep into the throat of the flower.

C. scabrum has an interesting history as the original description came from bulbs collected near Rio de Janeiro, Brazil. The presumed origin

was Africa and possibly introduced by early explorers or during the slave trade, but no species in Africa has ever been found that matches the bulbs of *C. scabrum* that circulate in US horticultural circles (D. Lehmler, pers. comm.). There is the possibility that it represents a stable hybrid. Red- and white-striped plants can be found in Brazil to this day. Some sterile and some able to set seed; perhaps several explanations lie behind the history of *C. scabrum* and other striped crinums of the Americas.

In any event, plants identified as *C. scabrum* make durable and sturdy plants in the Gulf Coast states and can be grown as far north as Dallas, Texas. They are fully hardy in USDA climate zone 9, and well into zone 8. Perhaps they will grow in colder areas if provided with proper winter protection. While not an absolute rule, anecdotal evidence suggests that many hybrid crinums seem able to survive temperatures below 10 F, if planted out as large bulbs, planted deeply, and planted in sunny locations. *C. scabrum* may be similar.

Many beautiful hybrids have been created with *C. scabrum* in their ancestry including: 'Stars and Stripes', 'Mermaid', and 'Margie Brown' (see the section on Rose City schoolhouse hybrids). If you only have room for a few crinums in your garden, make sure you try one of the *C. scabrum* types or (*C. zeylanicum*).

Crinum macowanii

C. macowanii is from Africa where it is reportedly widespread,

being found in various countries. The flowers can be exquisitely and delicately beautiful with recurved tepal tips. Typically the colors are white, pale pink, or white with pale stripes. Sometimes buds are exceptionally dark only to open pale pink. Some exquisitely beautiful specimens have flowers that resemble painted porcelain delicately lined with pink or rose-pink.

C. macowanii generally blooms in early summer, but it may produce several blooms over a month or more, and the flowers can be delightfully



Fig. 3. *Crinum scabrum* cultivar.

fragrant. The blooms may have a bell-like look about them as they mature and hang with the mouth of the flower facing downwards.

The flowers of *C. macowanii* (and many crinums) last better when blooming plants are well watered and protected from the hottest sun. *C. macowanii* is an easy garden plant, but like so many crinums blooms best after a few years in one location.

Crinum americanum

C. americanum is a plant of wet areas along the Gulf Coast states; there are reports of naturally occurring or naturalized plants along the coasts of Georgia and South Carolina.

The fragrant flowers often open in mid- to late-summer, and can be sweetly fragrant. The plant is not rare but is not commonly observed because it grows with semi-aquatic native irises, cattails, sedges, and plants of similar nature. Out of flower it is difficult to spot. Additionally, because it typically grows in wet areas, it is not often encountered unless you visit muddy places or bayous.



Fig. 4. *Crinum macowanii*.



Fig. 5. *Crinum americanum*.

However, the plant is exceptionally easy to grow and a lovely native plant. The only drawback is that it can be very reluctant to bloom in a typical garden setting. Best flowering is obtained by growing this species in boggy areas, along ponds, or in low parts of a garden that sometimes get flooded.

Though it can be a shy bloomer, hybrids of this species can be spectacular. It will produce hybrids with *C. scabrum*, *C. zeylanicum*, *C. bulbispermum*, *C. moorei*, and some uncharacterized garden crinums. Perhaps it will hybridize with other species as well. The hybrids are generally easy flowering plants suitable for a regular flower bed or a semi-wet area. Additionally, *C. americanum* will spread about by stolons, happily filling a corner of a yard.

Crinum erubescens is a more southerly species that resembles *C. americanum*. It has similar characteristics but flowers more easily because it does not require wet conditions for blooming. *C. erubescens* is reported from Mexico and South America. The flowers are white and fragrant.

Another plant that seems to share similarities with *C. americanum* and

C. erubescens is ***Crinum oliganthum*** although it is a much smaller species. It is sometimes offered for sale as “mini-Crinum,” or ‘West Indies Mini’. It enjoys wet growing conditions and rich soils, but it will bloom in a well-watered garden or even a small container (if suitably watered).

OTHER SPECIES FOR THE GARDEN

Occasionally, flowering-size bulbs of various *Crinum* species can be found for sale through bulb societies and specialty dealers. Alternatively, seeds of various species are sometimes offered for sale. Many of these plants are suitable for the garden but they are not widely available in the US. One reason they are hard to find is that they may be suitable only for Mediterranean climates or frost-free areas. Some species probably require dry dormant periods or they succumb to fungal infections.

Crinum moorei is a beautiful plant that is not often found in the eastern states, but it shows up in some gardens in California. *C. moorei* is unusual because it seems to prefer a shady situation for growing. It is reported to be a forest floor plant.

One important garden plant is ***Crinum jagus*** and the various *C. jagus*-like plants (*C. vanillodorum*, *C. rattrayi*, *C. scillifolia*). These white-flowered plants from Africa are hardy in USDA climate zone 9 and perhaps colder areas. Some enjoy semi-aquatic conditions and others do better in a typical flower bed. Some are wonderfully and powerfully scented.

MARCELLE SHEPPARD HYBRIDS

Marcelle Sheppard has been growing and breeding crinums for over 50 years. She has large growing grounds where she plants out seeds and waits to observe the results. She has been working on several different plans to produce crinums that have new colors, longer lasting flowers, larger flowers, taller flowers, more compact plants, etc. Additionally, she has grown out several exceptional *C. asiaticum*-type garden plants from collaborations with other breeders. Some of her creations are the *C. bulbispermum* ‘Jumbo Hybrids’, the *C. scabrum* ‘Rose City Schoolhouse’ series, the ‘Burgundy’ hybrid series, and *C. macowanii* hybrids.

Rose City Schoolhouse Hybrids

Rose City, Texas is a small municipality in east Texas, near Marcelle’s home in Vidor. Some years ago Marcelle noticed and collected two very similar

Crinum plants that grew at the schoolhouse in Rose City. She named them 'Rose City 1' and 'Rose City 2'. They have the red-striped flowers and wavy leaf edges that are characteristic of *C. scabrum*. Both No. 1 and No. 2 have been good seed producers and pollen donors, creating a number of offspring with various other *Crinum* species and hybrids.

Crinum x 'Margie Brown'

One of the most beautiful hybrids produced through the Rose City bulbs is 'Margie Brown'. The flowers are of good substance and have clear red-pink stripes upon white tepals (petals). Another beautiful hybrid was created when Marcelle crossed a *C. bulbispermum* 'Jumbo' type with one of the Rose City plants. She named this exceptionally pretty flower 'Liberty Bells' in 2006.



Fig. 6. *Crinum 'Margie Brown'*.



Fig. 7. *Crinum 'Liberty Bells'*.



Fig. 8. *Crinum 'Liberty Bells'* close-up.

Burgundy Hybrids

Crinum x 'Burgundy' is one of the first plants Marcelle worked with to create hybrids. The origins of 'Burgundy' are not well documented, but one source suggested that the plant is a hybrid between *C. scabrum* and *C. moorei*.

'Burgundy' accepts pollen from a variety of other crinums. Additionally, 'Burgundy' has proven to be a good pollen donor in some crosses. 'Burgundy' and its offspring bloom heavily in an East Texas garden and provide sporadic re-bloom; but their best performance is in early summer.

Some flowers of 'Burgundy' are streaked with white which is a trait that has shown up in some of the seedlings derived from 'Burgundy'. 'Lady Chameleon' is a Sheppard hybrid created in crosses with 'Burgundy' as one parent. 'Lady Chameleon' is special because it changes - sometimes throwing out flowers that are all reddish-pink, but other times providing all white flowers or even flowers that are half white and half red-pink.

Some of the most exceptional 'Burgundy' hybrids have pendant flowers and recurved petals suggesting that they have *C. macowanii* as the pollen parent. Over the past half dozen years Marcelle has grown out six exceptionally beautiful 'Burgundy' hybrids that she calls No. 1, No. 2, No. 3,



Fig. 9. *Crinum 'Burgundy'* seedling.

etc. These plants make offsets, but slowly. In time Marcelle will introduce them into commerce.

***Crinum macowanii* hybrids**

C. macowanii is an African species that does well along the Gulf Coast; it is carefree if provided with enough sun and water. Marcelle used this beautiful plant in various crosses and has created some spectacular new flowers.

Most *C. macowanii* hybrids bloom well and often have exquisite colors in rich shades of pink and rose. Some of the hybrids abound with flowers when several stems bloom at once. Marcelle has created a variety of *C. macowanii*-derived hybrids - some of great beauty. It is her intention to bring the plants into commerce as they increase, but it can be a slow process.

***Crinum bulbispermum* 'Jumbo' hybrids**

The first *C. bulbispermum* 'Jumbos' were hybrids produced by Les Hannibal, a California crinum breeder and long-time collaborator with Marcelle. He described the 'Jumbos' as fourth generation hybrids. They are

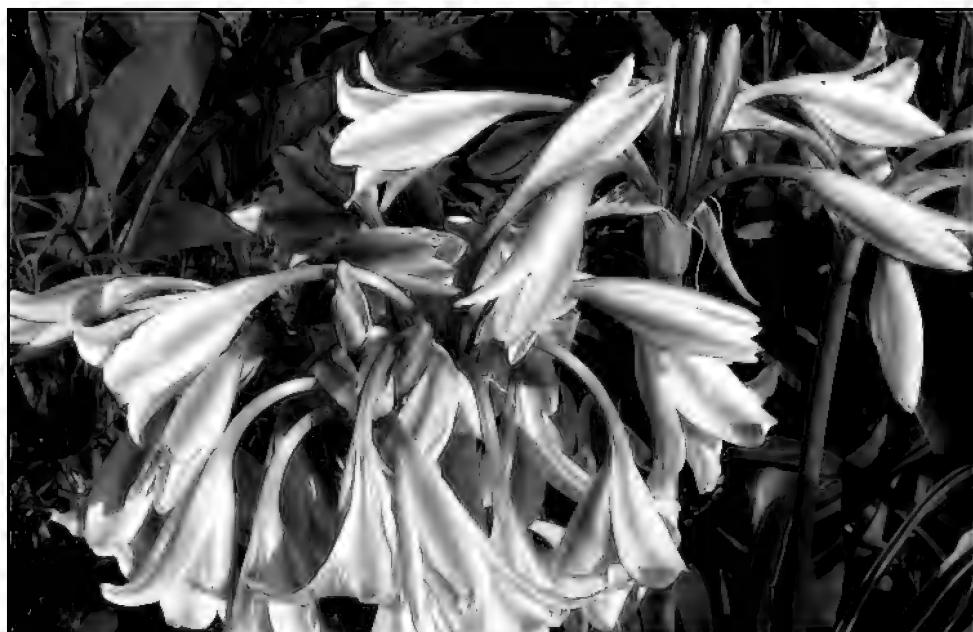


Fig. 10. *Crinum macowanii* x 'Rose City Schoolhouse' hybrid.



Fig. 11. Dark-pink *Crinum bulbispermum* 'Jumbo'.

C. bulbispermum-like in the foliage with blue-green or gray-green leaves, but have flowers with colors not characteristic of wild *C. bulbispermum*. Marcelle calls them 'Jumbo' hybrids because individual plants can grow large in the garden and are much larger than locally found, naturalized *C. bulbispermum*-like plants. The original 'Jumbos' from Hannibal do not produce offsets and are reproduced by seed. Their large size and lack of offsets makes them useful as long-term landscape plants, especially because they are evergreen throughout much of USDA climate zone 9. Additionally, the plants retain a neat and attractive shape without dozens of offsets producing a leafy confusion. Marcelle and Hannibal employed these plants in numerous crosses.

'Jumbos' were originally rose-colored, or pink-striped. However, in crosses, backcrosses, and self-crosses of the various 'Jumbos', Marcelle has produced some plants with blooms that opened white or the palest of pink, but which darken to rose on day two. Other plants have a nice rebloom in fall after slowing down in July and August (the hottest months).

'Jumbos' seldom produce offsets; rather they grow and produce huge, single bulbs. They set seed reliably and make good parents in many crosses because offspring inherit the durability and lasting flowers of *C. bulbispermum*, as well as the scape strength and large numbers of flowers

that are typical for the 'Jumbo' plants.

A 'Jumbo' crossed with a 'Jumbo' will yield 'Jumbo'-like progeny. Offspring may have blue-green leaves (as does *C. bulbispermum*) or may have green leaves more typical of other *Crinum* species; such progeny may have striped flowers or flowers of solid color, depending upon the precise cross. Marcelle has said, "Each generation brings on something new in shapes, and color, etc. Mr. Les Hannibal did something great when he worked to get this group of plants on the road to improvement."

If you can acquire seed, it is an easy project to build a garden full of beautiful crinums. The seeds reliably produce easy flowering plants with white, pink, or rose flowers (with or without keel stripes) that are held on sturdy, rainproof stems. Plants come into full bloom in 3-4 years under ideal conditions.

The green-flowered *Crinum*

The original 'Jumbos' were dark-colored, pink, or red-pink; variants emerged over time as Marcelle crossed and backcrossed them. The exact heritage of the *C. bulbispermum* 'Jumbos' is unknown, but it may be complex because, by selfing them or through crossing, different seedlings (light variants) began to emerge. It was a wonderful surprise when the



Fig. 12. *Crinum 'Emerald'*.

green-white variants emerged. These flowers look like Easter lilies tinged with green on the keels.

Eventually, Marcelle succeeded in her goal to create a crinum with all-green flowers (no white). The green-flowered *Crinum* has no name yet and Marcelle has not decided upon a name or even if this generation is garden-worthy; she is still testing for durability in rain and sun, etc. For now, she tentatively refers to it as 'Emerald'. Marcelle has not decided if this is a plant that is worth releasing or if a better plant is waiting in the wings. A few more years of evaluations will let her know which plant is the true 'Emerald'.

The flowers are held on scapes of medium height, and hold their color well (not changing on day two). Instead of a trumpet-type flower, the green-flowered *Crinum* has a flatter shape; the blooms flare nicely giving the flowers a friendly, open, and happy appearance.

The 'Champagne' *Crinum*

The 'Champagne' series is another Marcelle creation, obtained with lots of years of waiting and prudent culling.



Fig. 13. *Crinum 'Champagne'*.

‘Champagne’ *Crinum* No. 1: The original cross was *C. bulbispermum* ‘Alba’ x *C. flaccidum* (yellow form: *C. luteolum*). The F1 progeny were unexceptional pale or dull white. However, the F2 progeny (F1 x F1) produced some especially beautiful pale pink-flowered clones. Marcelle has decided that some of these plants represent a new crinum color; she has called it “champagne” to acknowledge the shimmering gold and green highlights overlain upon pale pink tepals.

Marcelle is evaluating several champagne-type seedlings including ‘Champagne No. 1’ (Marcelle’s “best champagne” so far), as well as ‘Champagne No. 2’. Of course, there is really no deciding which the best seedling is as they are all exceptional. For now, there are not enough plants to allow selling, and Marcelle is still evaluating them. Meanwhile, we can all enjoy the photographs.

Tropical Crinums

Marcelle has collaborated with growers over the world creating her own *C. asiaticum* hybrids, but she has also grown out seeds that were crossed by others. One plant of particular note is ‘Bride’s Bouquet’, a crinum that astonishes when it flowers its best, holding out multiple scapes and each with dozens of flowers.

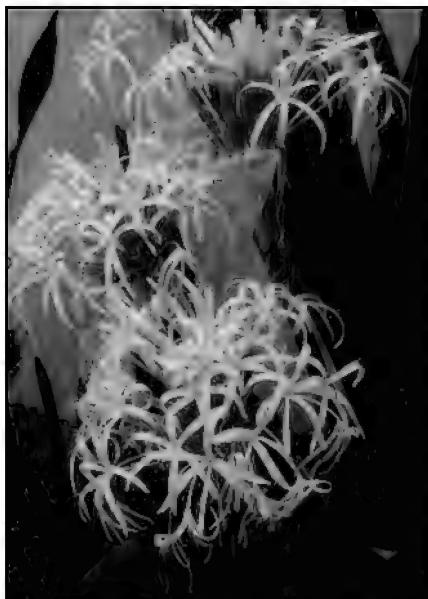


Fig. 14. *Crinum 'Bridesbouquet'*, initial blooming with 5 simultaneous scapes.

C. asiaticum plants and hybrids are hardy in USDA climate zone 9, but they may not be evergreen. In Conroe, Texas the plants are grown in 25-gallon containers and placed next to a house wall in winter. With such care they stay evergreen. In contrast, plants in similar containers suffer frost damage at about 28 F and lose their leaves.

Loss of leaves does not kill these tropical beauties, but it slows their overall growth and development; a protected tropical crinum might reach blooming size from seed in 3-5 years but take a year or two longer if unprotected. Plants may bloom a bit better if they don’t lose their leaves,

but it is difficult to be certain because of the spectacular shows produced by unprotected plants. Therefore, in areas where temperatures drop below 28 F for a few hours sometimes, the plants may be left in the open or may be given modest cold protection.

Special hybrids

Crinum 'Marcelle Sheppard'

Roy Works in Florida created this beauty; he crossed *C. oliganthum* 'West Indies Mini' with a 'Rose City Schoolhouse' *Crinum*. The plant is not as small as *C. oliganthum*, but it is small as *Crinum* hybrids go.

This delightful plant shows that *Crinum* flowers can be front-of-the-border plants and need not be 5 ft-tall giants. Moreover, Works reports that the plant is tough as nails. It does produce offsets and perhaps it will be available in commerce in a few years.



Fig. 15. *Crinum 'Marcelle Sheppard'* by Roy Works.

INSECTS AND DISEASES

Insects and fungi can attack crinums, producing unsightly lesions on the foliage or even damaging flowers.



Fig. 16. *Romalea microptera*, 'Southeastern Lubber Grasshopper' nymphs. (Photo courtesy of Mike Burnett.)

species because they are brown and yellow, with black markings and sometimes a bit of red. Both grasshopper stages can consume lots of leaves and flower buds. If you have a few crinums the pests may be removed by hand because, while quick on the move, they don't fly. Damaged leaves can be pruned away. Timely application of general garden pesticides (such as for roses or home vegetables) is also very effective. Remember, even so-called "safe" pesticides must be used with care for small children and pets.

Another insect pest that can cause damage is *Xanthopastis timais* (Spanish moth). The larvae enjoy munching on the foliage of crinums and related plants. Like the eastern lubber grasshoppers, Spanish moth caterpillars are easy to observe because they are large and distinctive. They can often be controlled by hand removal.

The main insect problems are grasshoppers or caterpillars, while fungal problems are mostly limited to leaf spot diseases. Unless there is a strong insect attack, there is no reason to worry about crinums, but now and then the eastern lubber grasshopper or Spanish moth can cause lots of damage.

The juvenile grasshoppers are about 1 inch-long and black with yellow or red markings; they are attractively marked and easily recognized. Later in the season the large adults seem like another



Fig. 17. *Xanthopastis timais*, Spanish Moth caterpillars, so-called "convict caterpillars". (Photo courtesy of Mike Burnett.)

Few pests can actually kill a bulb but sometimes crinums need a little grooming to look their best; a little effort can keep the tropical look of the foliage in perfect condition. Crinums are listed by several publications as deer-proof or mostly deer-proof, thereby adding to their overall utility.

Fungal Leaf Spots

Mild leaf spots are caused by fungi and can result in red-brown discolorations. In time, on some plants, spots can enlarge and coalesce into large areas of dead tissue. The dead areas should be trimmed away just as frost damaged leaves would be cleaned away.

Severe damage can be controlled by application of a garden fungicide, including products for roses.



Fig. 18. Fungal leaf spot disease.

Care Summary

Most of the widely available hybrids are hardy into USDA zone 7. However, small seedlings may not be as hardy as large bulbs; small plants can be brought along in 1- or 2-gallon containers for the first 2-3 years. Additionally, in areas where the soil freezes it is advisable to plant crinum bulbs deeply, with the bottom of the bulb as much as 10 or more inches below the soil surface. In cold winter areas crinums benefit from planting in the sunniest locations and a layer of winter mulch. Additionally, crinums in cold winter areas benefit from good drainage.

Crinums respond to fertilizer (see the section on *C. bulbispermum*) and can be fed as heavily as roses. However, crinums don't need to be fed extra heavily and a good spring feeding followed by an application in midsummer is usually sufficient. Garden compost and aged animal manure are excellent fertilizers, but crinums also respond to general garden fertilizers such as for shrubs or flowers.

Crinums adapt to pot culture and can be grown in large containers. An article by Lehmler (1997) describes his experiences growing *Crinum* species in containers. The Missouri Botanical Garden recommends rich,

well-drained potting soil for crinums. The pot should be 2-3 inches wider than the bulb (on both sides), and larger pots are even better. In cold areas the plants are allowed to dry down in fall and stored in the pot over winter, away from frosts.

***Crinum* Information**

There is a lot of information out there about crinums, but it is not always in one place. A little bit of exploring libraries, magazines, and the Internet will provide a lot of information.

The following books and articles are wonderful sources of information about crinums:

Howard, T. 2001. Bulbs for Warm Climates. Univ. of Texas Press.
Ogden, S. 1994. Garden Bulbs for the South. Taylor Trade Publishing.
Ogden, S. 2007. Garden Bulbs for the South. 2nd Ed., Timber Press.
Lehmiller, D. 2007. Cultivation of African *Crinum* in pots and tubs.

Herbertia 51:33-37.

Hannibal, L. 1970-71. Garden Crinums. Bulletin of the Louisiana Society for Horticultural Research, Vol. III, No. 5.

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